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FORMERLY

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WHOLE No. 3125

NEW YORK, SATURDAY, JANUARY 26, 1918

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Double Gas Output per Ton of Coal Obtained by Making Water Gas in Continuous Vertical Retorts

Practice Nine Months in Operation at Pernambuco, Brazil, Tends to Increase Life of Retorts —Carbon and Coke Production Reduced, Though Latter Not Materially

By HENRY M. BALSAM
Pernambuco Tramways and Power Company, Pernambuco, Brazil

Probably never before in the history of the gas industry has a set of vertical retorts been operated to produce a coal and water gas mixture with the water gas constituent running as high as 50 per cent.

This radical modification in retort house practice was a direct result of the tenseness of the coal situation in Brazil in the early part of 1917, it having become evident that urgent measures had to be taken to find a suitable substitute for coal or seriously curtail its consumption.

It should be noted here that approximately one-third of the total make of the Pernambuco company is generated in a carburetted water gas apparatus, while the balance is produced in the retort house. It was not desirable to go back to the old horizontal retorts that we had only recently abandoned in favor of a new set of Glover West verticals. A plant carbonizing wood will soon show the effects of the acid evolved in the process, and where old horizontals still exist it would be poor policy to sacrifice a new set of vertical retorts. Wood carbonization is at best an extreme measure, the difficulties and cost of lime purification on a large scale for the high percentage of carbon dioxide making it prohibitive where other means are at all available.

Fifty Per Cent Reduction in Coal Consumption Would Save Situation

We realized that if we could effect a 50 per cent reduction at once in the coal consumed, we would probably tide over the difficult moment, and for the time being, at least, save the situation.

Under the circumstances only one practical plan presented itself which combined the principal advantage of readiness of execution with that of a minimum expenditure. An improvised water gas plant had previously been considered, but was at once discarded because of the cost involved and the unavoidable delay of construction. Water gas was undoubtedly the solution to the problem, and the continuous vertical retort apparently offered the widest scope for immediate experiment, and, as the writer had the satisfaction of proving shortly afterwards, was most excellently adapted to the purpose.

Steaming Had Been Practiced

At that time we were already making about 10 per cent of water gas by slight steaming in the retorts, and it only required a little preliminary experimenting to prove to ourselves that the process could be carried much further. This we proved most conclusively with the tests that followed.

In the Glover-West Vertical Retorts the carbonizing process is continuous. The coal enters at the top and slowly travels down the length of the retort until finally discharged at the bottom in the form of coke. The process could best be described by quoting from Messrs. West:

"Coal is supplied to the coal feed hopper above each retort and slowly and continuously descends down the retort to the coke receiving chamber below. The coal in passing through the heated retort becomes thoroughly carbonized, and the residual coke is extracted by means of a mechanically operated extractor at the base of the retort. The speed of the coke extractor determines the rate at which the coal passes through the retort, and this speed can be varied to meet all requirements. As the coal passes continuously down the retorts, the heat gradually penetrates towards the center, the speed of coke extraction being so regulated that complete carbonization is effected towards the base of the retort, thus forming a taper 'core' of coal, as shown in the accompanying figures."

It is obvious that the slower the speed of the descending coal, the shorter will be the "core." If the speed

be so adjusted that the apex of the "core" is high enough up in the retort to leave an ample depth of incandescent coke below, the lower half of the retort can readily be made to answer the purpose of an ordinary producer.

Lean Gas Picks Up Hydrocarbons as It Travels

Dry steam injected under sufficient pressure into the base of the retort will be drawn up through the incandescent coke, producing water gas, that will soon find its way to the sides of the retort and thence out into the main with the rest of the gas.

This lean water gas readily picks up, in its upward course through the retort, those hydrocarbons which in the ordinary process of carbonization are absorbed and carried off by the tar, and are thus lost to the gas. It is well known that the hydrocarbons referred to can be reclaimed by cracking; that is to say, that tar in contact with an incandescent surface can be made to yield a fair portion of useful permanent volatile compounds. In this system the complete operation is accomplished inside the retort, the absorption by the gas is effected at a high temperature and the tar leaves the retort practically stripped of volatile constituency.

At present it is difficult to say which of the hydrocarbon series is mostly responsible for the enrichment. There is no doubt that they are absorbed and retained by the mixture that finally leaves the retort, and that the product is much superior to any that could have been expected. The composition of the tar, which, unfortunately, I cannot give here, and the diminished production per ton of coal, together with many other minor indications in the retort house mains, all lend support to this theory.

Excess Quantity of Steam Employed

A thoroughly balanced operation inside the retort, where the gases are at once generated and intimately mixed under the influence of high temperature, could easily explain the conversion and absorption of various hydrocarbons which otherwise would have found their way to the tar well. As the carbon of the coke present in the retort is far in excess of the quantity of steam injected, there is no reason to suppose that any of the coal gas hydrocarbons could have passed through decomposition. And while it must be admitted that the quantity of steam employed is considerably in excess of the theoretical quantity required, it must likewise be granted that the loss is comparatively small and could have been altogether avoided in retorts where the outgoing coke was not utilized for preheating the secondary air.

Scurfing Loss Reduced

Incidentally a portion of the carbon requirement for the operation is met by some of the graphite formed in the retort. This is of considerable importance, especially where there is little or no market for this product, as happens to be the case here. The scurfing loss, previously rated here at 3½ per cent, is now reduced to approximately one-half, and retort wear, the unavoidable accompaniment of scurfing, is naturally reduced in the same ratio. It may be mentioned here that it is the carbon in the lower half of the retort that enters mainly into the composition of the water gas, because the entire water gas process is localized in that section, and what little carbon is required to be removed in scurfing comes almost entirely from the upper end of the retort.

It is clear, from the nature of the process, that a strong tendency towards overheating should exist at a point about midway up the retort. A somewhat reduced temperature maintained at this point outside the retort will easily check this tendency, while a practically uniform temperature is otherwise maintained throughout.

Coke Production Smaller

A decided advantage, and one that is not to be underestimated, is that the coke now fails to hang up inside the retort, as it frequently did under normal operation. On the other hand, the fuel consumption under the benches is higher and the coke production smaller than under plain carbonizing conditions. The coke, however, does not seem to leave the retort any cooler than it did before, and the secondary air so far gives no indication of having suffered any appreciable reduction of temperature.

Dry steam is injected into the base of the retort under 40 lb. pressure. While superheated steam would have been preferable, it was not available, and it is doubtful if the cost of the necessary installation to produce it would have been warranted. Owing to the cooling action of the secondary air on the outgoing coke (a feature of the Glover-West retort), a portion of the steam is wasted through condensation.

Steaming Intermittent Verticals

Few lines of comparison can be drawn between the steaming of intermittent verticals and the process just described. In the former it is a case of alternate periods of carbonization and water gas production. The relatively small duration of the water gas period, owing to the impossibility of sustaining the necessary temperature in the coke mass, confines the process as applied to intermittent vertical retorts within rather narrow limits for the present. So far, to my knowledge, probably no more than about 12 per cent of water gas has been produced at the end of any one carbonizing period. In the process, as we have applied it to the continuous vertical retort, it is a perfectly balanced operation, with no limitation except that imposed by the minimum calorific value to be maintained.

The production per ton can be doubled without any increase in labor, and apart from the loss entailed through diminished coke production and increased bench fuel, steam is the only item of expense to be taken into consideration.

While it is aimed to maintain a nearly uniform external temperature of 2,000 deg. Fahr. throughout the full length of the retort, it would be quite impossible at this moment to say with any exactitude what degree of temperature is to be found at the various elevations inside the retort. There is no doubt but that the requisite temperature for water gas making is uninterruptedly maintained, in part, by the inherent heat of the slowly descending coke and in part by the heat transmitted to it from without.

The retorts are 21 ft. long, 39 in. x 18½ in. at the base and 33 in. x 8¼ in. at the top. Out of the 21 ft.

of length 4 ft. at the base are utilized in the extraction of heat from the outgoing coke, mainly for preheating the secondary air and incidentally for cooling the coke, so that in reality there only exists 17 ft. of active retort.

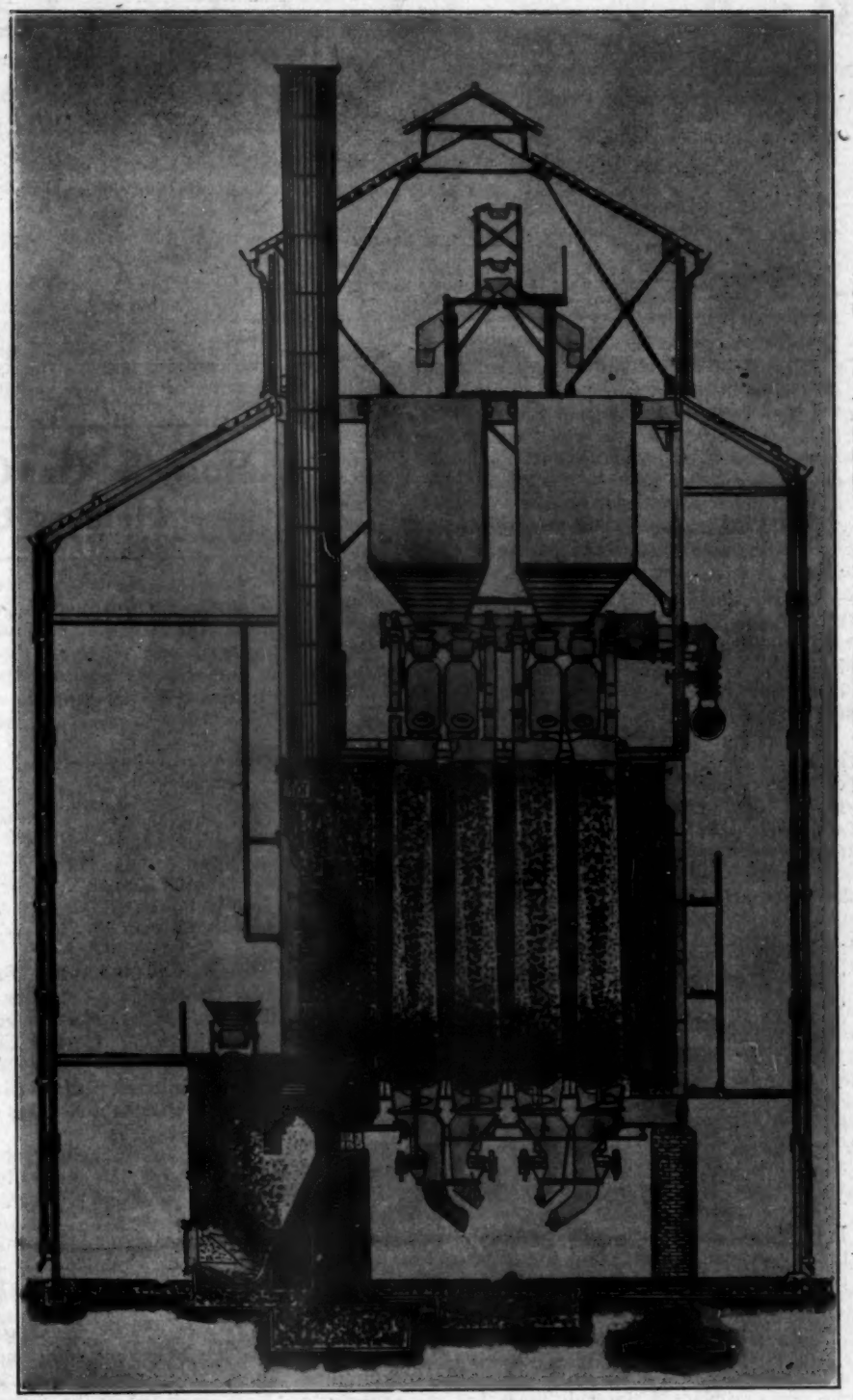
Comparative Results

The following comparative table on page 76 shows on one hand the results obtained prior to our experiments in the early part of 1917, and on the other hand those that have been obtained by us since then. Slight steaming was practiced by us ever since the date of inauguration of the vertical retorts, and it cannot be denied that the results even then were exceptionally good. The results achieved under the new method of operation, however, have surpassed all our expectations.

It is quite evident from the table that there is a 27½ per cent increase in retort capacity. Also that the gas produced per ton of coal is nearly double that which could be produced in vertical retorts with plain carbonization. It is true that the calorific value is low and the candle-power very diminutive, but it must be remembered that the open-flame burner has long since been eliminated here and the candle-power standard justly disregarded.

Loss of Coke

The loss of coke sustained through diminished production is 5.8 per cent, and added to it is a 6.4 per cent loss due to increased bench fuel, making a total of 12.2 per cent. While this represents a considerable loss, especially where coke sells high and coal is relatively cheap (which is not often the case), one must not forget that the main item of carbonization expenditure has been reduced to just one-half, and the net result must of necessity be a satisfactory one.



SPEED OF DESCENDING COAL SO ADJUSTED THAT APEX OF CORE IS HIGH ENOUGH UP IN RETORT TO LEAVE AMPLE DEPTH OF INCANDESCENT COKE BELOW SO LOWER HALF OF RETORT IS MADE TO ANSWER PURPOSE OF ORDINARY PRODUCER

After all, 12.2 per cent only represents the economy of fuel effected in our modern gas-fired benches over

Coal Used: Arley	Plain Carbonizing (Slight Steaming)	Combination Coal and Water Gas Production
Coal carbonized per retort per 24 hours	1,845 kilos	1,224 kilos
Gas produced per retort per 24 hours	738 cu. mts.	950 cu. mts.
Gas produced per ton of coal	400 cu. mts. (14,120 cu. ft.)	776 cu. mts. (27,390 cu. ft.)
Coke produced per ton of coal (dry)	693 kilos	640 kilos
Percentage coke produced per ton of coal (dry)	69.3 per cent	64.0 per cent
Fuel consumed per retort	0.262 kilos	0.255 kilos
Fuel consumed per ton of coal	129 kilos	188 kilos
Percentage consumed per ton of coal	12.9 per cent	18.8 per cent
Calorific value	540 B.t.u.	436 B.t.u.
Candle-power	14.5	5.0
Per cent CO_2 (average of tests) in gas	1.8 per cent	3.5 per cent

the old-fashioned, direct-fired settings.

It must be noted that the percentage of CO_2, while not below 3.5 per cent, is still within reasonable limits.

By operating a carburetted water gas plant, as we do, in conjunction with the retort house equipment, there is no difficulty in sending out an improved quality of gas with a higher calorific and candle-power value. In the carburetted water gas plant we produce a 16 candle-power, 590 B.t.u. gas, which when finally mixed with the retort house gas gives us a 9 candle-power, 490 B.t.u. gas of satisfactory quality.

In addition to all this, we have installed an oil enrichment apparatus that can be adjusted to spray gas oil, coal tar, water gas tar, or any product of the tar Still into any of the retorts in operation. This would become necessary in case of temporary shutting down of the carburetted water gas plant.

The economy of fuel effected in this system of water gas product over that of an independent plant will become quite obvious by a reference to the above figures. It will be noted that the quality of the mixed gas will more than favorably compare with the usual theoretical figures.

Innovation Has Stood Nine-Month Test

It stands to reason that a coal and water gas, each separately produced and mixed within the holder, cannot be compared to a mixed gas produced under these modified conditions.

In generating gas in an independent plant where coke is used, approximately 0.620 kilos of coke is required for each cubic meter of gas made. Generating water gas in the retort house, as is being practiced here, only takes 0.372 kilos of coke per cubic meter of gas. Besides interest and depreciation on plant, repairs and wages must be added to the former. In the latter there is only a slight loss of steam to be charged against it. It is at once evident that the cost of water gas production in an independent plant would be at least twice as great as in the vertical retorts.

After running continuously for nine months with the coal reduction reduced one-half, one cannot but feel the tremendous importance of this new adaptation. At a moment like this, when coal and its transportation is the great problem, I sincerely hope that our experience will be of general interest to the gas industry, and especially to those who, like ourselves, are fortunate enough to have a continuous vertical retort installation, proving itself as it has to be most flexible and adaptable as well as economical coal gas plant on record.

I beg to acknowledge my indebtedness to W. C. Butler, general manager of this company, for his kind co-operation and for the assistance that made the publication of the above possible.

How the Gas Companies Are Helping the Nation

J. W. Galloway, formerly of the Consumers Gas Company, of Reading, Pa., is now with the 1st Pennsylvania Engineers, Company B.

The Southern Counties Gas Company, of Philadelphia, Pa., has the following employees absent from its offices and doing military and naval duty:

Oliver Breckenridge.....9th Pa. Engineers
T. Nevin Fike.....Phila. Div. G. M. Enlisted R. C.
Linford C. Gurr.....U. S. Navy
George Harry.....Camp Meade
Samuel H. Hibbard.....Battery A, 2nd Pa. Artillery
James S. Maguire.....Troop D, 1st Pa. Cavalry
John A. McCullough.....Battery F, 2nd Pa. Artillery
John H. Powell.....Marine Corps
Christian Wanzel.....Company I, 6th Pa. Infantry

C. N. Leuchsenring, formerly an employee of the New Bedford Gas & Edison Light Company, of New Bedford, Mass., is now a sergeant stationed at the concentration camp, Garden City, L. I.

The Chester County Gas Company, of West Chester, Pa., has the following employees in the service of the nation:

Clement R. Bair.....Camp Meade
Elmer L. Eppenheimer.....Company I, 6th Pa. Infantry
Ellsworth Nichols.....Company I, 6th Pa. Infantry

William J. Lutz, formerly employed by the Consumers Gas Company, of Reading, Pa., is with Company A, 4th Pennsylvania Infantry.

James W. Culligan, assistant supervisor, and Sidney L. Tirrell, of the meter reading department, of the Rochester Railway & Light Company, of Rochester, N. Y., enlisted in the Signal Corps (aviation section), United States Army. The boys left for Fort Slocum, New York, on Dec. 13, 1917. A large delegation of friends and employees were at the train to say good-bye. Mr. Culligan was presented with a wrist watch by the boys and girls of the meter reading department and main office before leaving.

The Gas Appliance Testing Laboratory—Part V

Testing the Gas Range Oven—Impossibility of Determining Efficiency—Worth, However Can be Determined Relatively—Proper Consumption for Particular Sizes of Ovens—Using Water as a Testing Medium—Top Burner Efficiency

By H. M. RILEY and L. B. WILSON, JR.
Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.

Although probably the most widely used of all gas appliances, the domestic gas range is, on the whole, perhaps shown the least consideration by testing laboratories. It is also a fact that this pioneer of the gas-fuel business is unconsciously much maligned.

The question is, "Is the gas range inefficient and are we justified in applying the word 'efficiency' in its strictest meaning when considering the matter of attempting to lay down and formulate certain definite rules and methods for closely approximating the thermal worth of a gas range?" We all know that the oven of a gas range probably has varying efficiencies, depending on a great many variable factors, such as rate of burning of gas, amount of food in the oven, character of the food, etc. Therefore, before proceeding with suggested methods for testing and the reasons for the same, let us consider what is meant by the expression: "The efficiency of the oven of a gas range." We can best explain this matter by an adaptation of Dr. Richards' very interesting explanation as applied to the consideration of metallurgical furnaces. (See Vol. 1, "Metallurgical Calculations," J. W. Richards.)

Efficiency of Gas Appliances

It is obvious that practically all gas-consuming appliances, with the possible exception of lighting fixtures and the like, or rather those whose utility depends on the generation and application of heat, will fall into three classes, insofar as efficiency is concerned:

1. Generic efficiency.
2. Specific efficiency.
3. Combination of generic and specific efficiencies.

1. Generic Efficiency

Under this heading will come those appliances in which we are primarily interested in maintaining a certain desired temperature, and, of course, with a minimum consumption of gas. Therefore, when similar appliances in this class are compared, their efficiencies can only be matched in a relative sense. Also in the case of these appliances practically all the heat evolved by the burning gas leaves the appliance as radiant heat, conducted heat, or heat in the flue gases. This is true where there is not a definite amount of thermal work to be accomplished, and also where one is chiefly concerned in turning out a piece of work in a given space of time. As examples of appliances where efficiency is used in a generic sense, we might mention a soldering copper furnace, where the tinsmith's coppers are kept at the proper heat during the time he is working, a furnace in the mint for keeping gold melted, etc. In considering these cases, it will be readily seen that we can only say that one soldering furnace is 15 per cent better than another, because it uses correspondingly less gas than the other in keeping the coppers at the desired temperature for a given space of time. In this case we cannot apply a rating on the basis of specific efficiency, inasmuch as practically none of the heat generated can be readily isolated in terms of B.t.u. for comparison against the total heat evolved.

2. Specific Efficiency

Specific efficiency concerns the thermal rating of those appliances where a certain thermal piece of work is accomplished with a minimum expenditure of gas, and accordingly where we are enabled to compare efficiencies on an exact basis. Moreover, in appliances under this heading, we can with facility exactly calculate how much heat is used in a certain operation wherefrom the efficiency and other distribution of the total heat supplied can be calculated. In some cases the heat usefully imparted is measurable in terms of thermometer readings, or sensible heat; in other cases, the heat is used in overcoming certain chemical affinities and physical states. At all events, all the portions of heat so used totalled up represent a figure which, divided by the total heat used, gives the specific efficiency.

A striking example of specific efficiency of an appliance where all the useful heat appears or is measured as sensible heat, is the circulating water heater. As an illustration of an appliance with a specific efficiency wherein the useful heat is made up of sensible heat and heat used in overcoming a certain physical state, we can cite the gas-fired steam boiler. In this case some of the useful heat is utilized in raising the water to the boiling point and the remainder of the useful heat converts the water at the boiling point into steam. Sometimes the proposition of the specific efficiency of an appliance merges into and is affected by general conditions. For example, a gas water heater might heat a definite amount of water to a certain degree of temperature with the expenditure of a given quantity of gas, and naturally the question as to how many heat units (represented by the heated water) are stored in a tank depends entirely on the size of tank, whether covered or uncovered, arrangement of piping, etc. In short, it depends on the general efficiency of the system, exclusive of the heater.

3. Combination Efficiency

It can be realized that in numerous cases the generic and specific efficiencies are present during the operation of certain appliances, in which circumstance we are generally able to differentiate the two and calculate them independently. Thus in the case of a gas-fired pot for melting solder which is subsequently cast into usable shapes, we expend a certain definite amount of useful heat in bringing the solder to the melting point, and still another definite quantity in melting the mass. At this latter point the matter of specific efficiency ceases to exist, practically speaking, and the amount of heat necessary to apply in order to keep the solder in

a melted condition falls in that class of data which is useful in calculating the generic efficiency.

We can readily see that we can segregate the two efficiencies in such a case as stated above, or we can calculate the thermal performance on the basis of specific efficiency as an over-all proposition.

Efficiency of the Gas Range Oven

On the basis of the foregoing discussion, we might reasonably conclude that where the efficiency of an appliance falls in the "specific efficiency" class, it will be a comparatively simple proposition to test for and calculate its efficiency. Also, when we grant the contention that the efficiency of a gas range oven is a "specific" one, we might carry our deductions further and state that it should be a fairly easy matter to at once arrive at the exact figure for rating the oven's efficiency. However, we will endeavor to show by some statements and concrete examples why this much desired thing is practically impossible of attainment.

Let us take as our first illustration the case of roasting a piece of beef in the oven. At first the albumen on the surface of the meat coagulates and the tissue is changed by the heat into gelatin. Later, the fibrin and albumen oxidize, the fat cells break down and there is a union of some of the liquid fat with the salt (NaCl) of the meat. Also certain phosphates in the blood undergo the process of chemical combination. And while the above phenomena are taking place there is a continual evaporation of moisture going on. Now if we quantitatively knew the extent of the above physical and chemical changes, as well as their heat-absorbing or heat-evolving values, it would be an easy matter to sum up all the factors involved, and therefrom calculate the efficiency of cooking the roast. Unfortunately, we do not know the extent of oxidation, or of the physical and chemical changes, and we are forced to search around for a more or less makeshift method for rating the oven. But before going into this phase of the matter, we might consider the case of baking a batch of bread. Here we also have such items as oxidation, evaporation of moisture, chemical reactions involving sugar, starch, alcohol, carbonic acid and what not. As in the case of the roast of meat, we do not know definitely what happens when the dough is baked into bread, and here, too, we are "at sea" to accurately estimate the summated usefully applied heat.

In addition to the obstacles just stated, we also know it to be a fact that the efficiency of a gas range oven will vary greatly, depending on the amount of food to be cooked, and will increase up to a certain point the more food there is in the oven.

The Proper Consumption of Gas

In view of the preceding discussion, we can say with certainty that it is a practical impossibility to determine the exact efficiency of the gas range oven to any degree whatever. Fortunately, however, there are several schemes of testing whereby we can determine the oven's worth in a relative sense quite accurately. In the first place, with the proper consumption of gas, the oven should attain a certain average temperature in a reasonable length of time. This "proper consumption" of gas is probably as follows: 35 to 37 cu. ft. per hour (600 B.t.u. gas) for a 12 x 16 x 16-in. baking oven; 38 to 40 cu. ft. per hour (600 B.t.u. gas) for a 12 x 18 x 18-in. baking oven.

The writers' experience leads them to believe that the above figures form the proper consumption for the particular sizes. It is based on the fact that if too high a consumption is used, the burners will become extremely hot, with the result that warping is quite liable to occur in a comparatively short space of time. Also, the higher the consumption the greater the likelihood of odor from the flue and the greater the possibility of uneven heat distribution in the oven. As far as the time element and rise in temperature are concerned, data obtained from customers over a long period of time leads us to suggest a rise to about 400 deg. Fahr. in about fifteen minutes. In addition, the oven should attain its maximum temperature in approximately one hour's burning. These temperatures can be ascertained by introducing the bulb of a long stem thermometer into the oven (through either top or side lining), and at the point of average temperature. This point of average temperature will, as a rule, be nearly in the center of the oven. If one does not care to go to the trouble of making a hole through the oven linings for the introduction of the thermometer, the same, if short enough, can be placed wholly within the oven and the temperature read, say, every fifteen or twenty minutes. This scheme is not quite so accurate, since each time the oven door is opened there is a considerable quantity of air that rushes into the oven, thereby causing a slight cooling effect. In Fig. 14 is shown a heating-up curve for the baking oven of a gas range. Incidentally, this curve indicates only a fair range as far as the rapidity of the rise and maximum temperature are concerned. It is interesting to note the rapid rise of temperature in the first thirty minutes and the subsequent flattening out of the curve in the last ninety minutes. Other items worthy of mention along this line are:

1. The maximum flue temperature is about 150 deg. lower than the maximum oven temperature.
2. More excess air per unit volume of gas burned passes through the oven at the end of, say, an hour than at the end of fifteen or twenty minutes.

Distribution of Heat

The second important feature in testing the oven is to determine the evenness of the distribution of heat in the oven. This is necessary since the oven might be first class in other respects and yet perform the operation of cooking very badly, with the result that foods, particularly cakes, pies, bread, etc., would be non-uniformly cooked and browned. Also, the oven should show uniformity of heat distribution at different levels, even though at different heights in the oven the temperature might be different. There are several ways whereby the distribution of heat can be determined, two of which we will mention:

1. Direct determination by baking biscuits.
2. Indirect determination by using greased paper.

In the first case, a batch of biscuit dough is made up according to the following directions: Two average size cups of flour are well mixed with one and a half teaspoonfuls of salt and three teaspoonfuls of baking powder, and the whole is wetted and mixed with three-quarters cup of milk. By weight the flour is 62 per cent and the milk 38 per cent. Next the batch is rolled into a flat more or less oval mass and circular pats of

the usual size are cut out and placed evenly in a pan on about 4½ to 5-in. centers. The two oven burners are then lighted with cocks full open and the oven is allowed to heat for ten minutes, whereupon the pan with the dough pats is placed therein at whatever level it is desired to test. Then after ten minutes the resulting biscuits are examined, and if this space of time is not sufficient to give a good indication, they are allowed to bake for two or three minutes longer.

By this time, unless the oven is very inefficient, the biscuits should be nicely browned, and they are taken from the oven and examined. If the oven has a good heat distribution the tops of the biscuits will obviously be rather uniformly browned. On the other hand, bad heat distribution will be indicated by part of the biscuits being very dark brown and part very light in color.

The indirect method is carried on by taking a sheet of clean white paper, 14 x 14 in the case of a 16-in. oven and 16 x 16 in the case of an 18-in. oven, and impregnating it with grease, preferably ordinary leaf lard. The impregnating process can be best accomplished in one of two ways:

1. By heating the lard to a thin consistency and applying it to the paper by means of an ordinary paint brush.
2. By immersing the sheet into a vessel of heated lard and hanging it up to drain off any surplus of the lard.

After being greased, the paper should be allowed to hang in a normally cool place for an hour or so. Then it can be placed in the oven, which has been previously heated, and allowed to remain until a definite indication of browning shows itself. Of course, the final step is an examination of the paper for degrees of browning, as in the case of the biscuits.

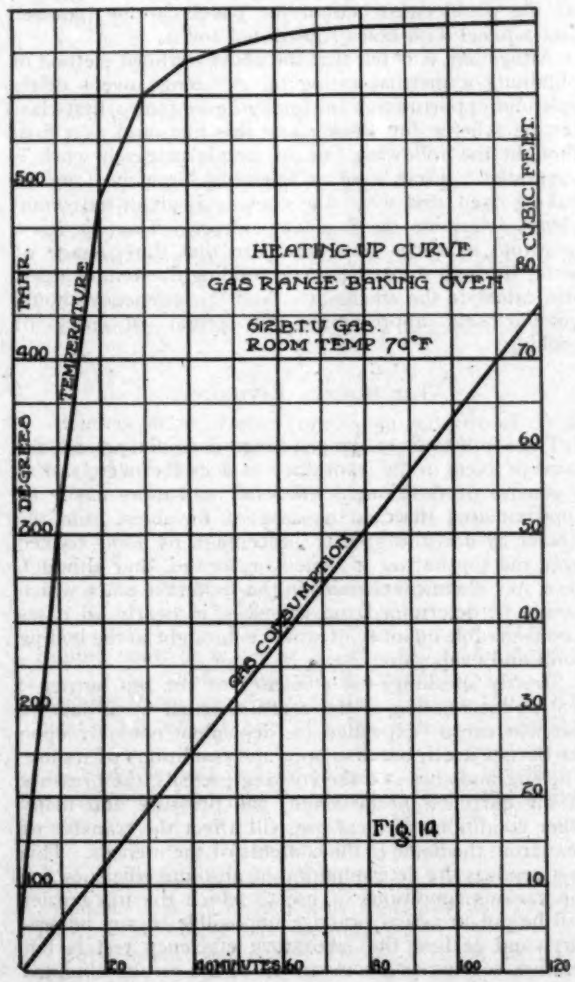


Fig. 14

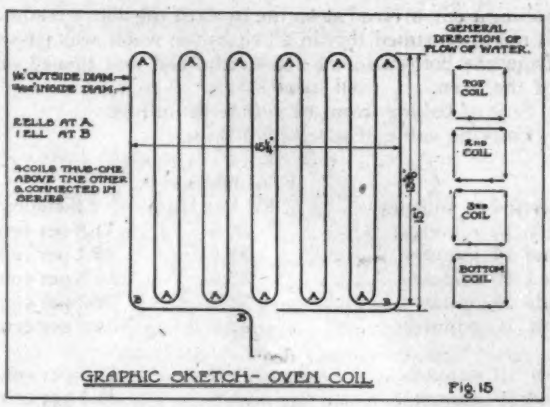


Fig. 15

Testing for Efficiency Index of Oven

The thought has often suggested itself to the writers that in addition to the usual run of tests on a gas range oven, it would be highly satisfactory to devise a scheme which would give an index of the efficiency of the oven in a relative sense. Accordingly, after much thought and experiment on the subject, the use of water as a testing medium was considered to be both simple and consistent as far as giving results is concerned.

At first, shallow pans of water were used to find the heat content of the baking oven in a given time. This method consisted in placing the pan or pans of water in the oven, lighting the burners, and after a specified length of time determining either the rise in temperature or evaporation of the water and calculating the useful heat therefrom.

It was found, however, that this method of testing did not give satisfactory and concordant results. Thereupon, a pipe manifold was devised which could be introduced into the oven and water circulated through the same at any desired rate. Fig. 15 shows a manifold coil consisting of four sections. The method of testing out the baking oven with this apparatus is as follows: The manifold is placed in the oven, preferably with the bottom coil not resting on the bottom but on supports. Water is then started circulating through the coil or manifold, and at the desired time the burners are lighted and the water is deflected into a convenient receptacle for weighing. Then at regular intervals the inlet and outlet water temperatures are recorded. Gas meter reading and other necessary data, as in the case of the circulating water heater, are noted. The efficiency can be determined in one of several ways. First, it can be gotten for the time it takes the water to arrive at a constant outlet temperature. Second, it may be determined for a period after the outlet temperature has gotten constant. Lastly, it can be gotten over a time including both heating up and after heating up. Below are given some figures for the efficiency of a gas range

baking oven, arrived at on the basis of the above method. It might be stated that in all cases the water was passed from the bottom to the top of the coil and thence out of the oven.

Size of baking oven, 16 x 16 x 12 in. high.
Calorific value of gas = 600 B.t.u.

Period of Burning	Consumption Cu. Ft. Per Hour	Efficiency
1st 10 minutes	32.5	11.8 per cent
2nd 10 minutes	32.5	26.1 per cent
3rd 10 minutes	32.5	30.3 per cent
4th 10 minutes	32.5	32.3 per cent
5th 10 minutes	32.5	34.0 per cent
1st 10 minutes	35.8	12.3 per cent
2nd 10 minutes	35.8	25.7 per cent
3rd 10 minutes	35.8	31.3 per cent
4th 10 minutes	35.8	33.6 per cent
5th 10 minutes	35.8	34.9 per cent
1st 10 minutes	41.3	13.6 per cent
2nd 10 minutes	41.3	27.1 per cent
3rd 10 minutes	41.3	32.3 per cent
4th 10 minutes	41.3	33.6 per cent
5th 10 minutes	41.3	34.4 per cent
1st 10 minutes	45.0	15.8 per cent
2nd 10 minutes	45.0	29.6 per cent
3rd 10 minutes	45.0	32.9 per cent
4th 10 minutes	45.0	37.1 per cent
5th 10 minutes	45.0	36.5 per cent
1st 10 minutes	53.5	15.1 per cent
2nd 10 minutes	53.5	31.1 per cent
3rd 10 minutes	53.5	34.8 per cent
4th 10 minutes	53.5	35.2 per cent
5th 10 minutes	53.5	36.8 per cent

These figures are quite interesting, and evidently show that in the case of this range its maximum efficiency is obtained when burning gas at the rate of 45 cu. ft. per hour. However, at this rate of consumption, and, indeed, with any consumption over 40 cu. ft. per hour, the burners became dull red in about forty minutes, and hence a higher rate of 50 or more cubic feet per hour would not be practical for the consumer to use.

The same test coil used in an oven 18 x 18 x 12 in. high gave the following results:

Period of Burning	Consumption Cu. Ft. Per Hour	Efficiency
1st 10 minutes	34.2	15.3 per cent
2nd 10 minutes	34.2	30.8 per cent
3rd 10 minutes	34.2	35.9 per cent
4th 10 minutes	34.2	38.9 per cent
5th 10 minutes	34.2	38.9 per cent
1st 10 minutes	38.8	17.6 per cent
2nd 10 minutes	38.8	28.4 per cent
3rd 10 minutes	38.8	35.0 per cent
4th 10 minutes	38.8	37.1 per cent
5th 10 minutes	38.8	37.1 per cent
1st 10 minutes	43.7	15.1 per cent
2nd 10 minutes	43.7	30.0 per cent
3rd 10 minutes	43.7	34.7 per cent
4th 10 minutes	43.7	35.9 per cent
5th 10 minutes	43.7	37.7 per cent

At the latter consumption (43.7 cu. ft.), in about fifty minutes' time the burners were red, and in this case about 40 cu. ft. per hour would be the proper consumption. It might be argued that a consumption of around 34 cu. ft. per hour would be advisable, since it shows a slightly higher efficiency, but here the time element enters into the question and the slight loss in efficiency is more than compensated by the gain in speed of cooking. Of course, a proportionately larger manifold would have given slightly higher efficiencies in the case of the 18 x 18 x 12 in. high oven.

The manifold can also be used in the lower or boiling oven of the range for finding its relative broiling ability.

Method of Introducing Manifold

The method of introducing the manifold into the oven does not present any great difficulties, as the only point to be taken care of is that of providing openings for the inlet and outlet pipes. If the range has a solid door, it is a simple matter to drill the proper sized holes in it or else a cast-iron door with holes can be kept as part of the permanent laboratory equipment. If the door is of the panel construction, the panel can be removed and a panel with holes substituted for it.

Altogether, it is felt that the above outlined method of obtaining a thermal rating on gas range ovens offers splendid opportunities for finally developing a first-class testing scheme for work along this line, and as a final thought the following line of simple research work is suggested: First, cook a tolerably large meal in the baking oven, and when the cooking is about half completed determine the flue temperature. Then design a manifold of such shape and size that the passage of water through it gives a corresponding flue temperature, and calculate the efficiency. And this efficiency should quite closely approximate the actual efficiency of cooking.

Top Burner Efficiency

The top burner of the gas range does not present the same problem in the laboratory as does the oven, and as a general proposition its efficiency can more easily be approximated than in the case of the oven. On the whole, by far the greater percentage of food cooked over the top burner is boiled or stewed, and although here, too, chemical changes in the food take place which cannot be determined; nevertheless, in nearly all cases a considerable quantity of water is brought to the boiling point and evaporated.

Strictly speaking, the efficiency of the top burner—that is, the relation of the useful thermal work done to the heat energy expended—is dependent not only upon the burner itself, but also upon the conditions of its use. The size and shape of the cooking utensils, the pressure of air currents in the room, gas pressure and many other conditions of local use will affect the transfer of heat from the flame to the contents of the utensils. This fact renders the determination of absolute efficiency for the various conditions of use to which the top burner will be put in actual practice impossible to any laboratory, and at best the laboratory efficiency test is but relative, serving as a comparison of the results obtained

from different burners under certain standard conditions of test. These standard conditions must be determined upon by each laboratory, and should, of course, represent the average conditions which must be met in actual use in the particular territory wherein the range is to be used.

The general method of testing for top burner efficiency is to adjust the burner for the average gas pressure and desired gas consumption, and then to determine the amount of heat transferred to water contained in a suitable vessel of average size and ordinary form. The ratio of the amount of heat transferred to the water to that expended in the combustion of the gas will represent the efficiency.

In making this test, some laboratories raise the temperature of the water to a temperature of about 200 deg. Fahr., which requires that considerable attention be given to accurately noting the temperature rise.

The authors feel that inasmuch as the top burner is generally used for boiling, a preferable method is to bring a certain quantity of water to the boiling point, and having allowed it to boil for a certain time to determine the heat absorption by noting the amount of evaporation produced.

As an example, let us assume the following data as gathered from a test conducted on the top burner of a certain gas range:*

DATA

Gas consumption, 7.45 cu. ft.
Gas pressure, 2.0 in. (water).
Gas temperature, 80 deg. Fahr.
Gas calorific value, 605 B.t.u.'s.
Weight of water in test pan at start of test, 5 lb.
Weight of water in test pan at end of test, 3.844 lb.
Initial temperature of water in the test pan, 70 deg. Fahr.
Temperature of room, 80 deg. Fahr.
Barometer, 30.50 (corrected for temperature).

CALCULATION

The correction factor for the temperature of 80 deg. Fahr. and the barometer of 30.50 is 0.963 (see Table No. 1, Part III).

$$7.45 \text{ cu. ft.} \times 0.963 = 7.17 \text{ cu. ft.}$$

Heat produced by the combustion of gas =
7.17×605 B.t.u.'s = 4,338 B.t.u.'s

Heat Transferred to Water

SENSIBLE HEAT

Boiling point of water at 30.50 = 212.9 deg. Fahr.
(See Table No. 6, Part III)
Heat in 1 lb. of water at 212.9 deg. Fahr. = 180.92 B.t.u.
Heat in 1 lb. of water at 70 deg. Fahr. = 38.06 B.t.u.

Sensible heat in 1 lb. of water....	142.86 B.t.u.
Sensible heat in 5 lb. of water....	714.3 B.t.u.

LATENT HEAT

Weight of water evaporated, 5 — 3.844 = 1.156 lb.
Latent heat of evaporation from and at 212.9 deg. Fahr. = 970.06 B.t.u. per pound.
Total latent heat equals $970.06 \times 1.156 = 1{,}121.4$ B.t.u.

Total heat transferred to water:

714.3 sensible heat
1,121.4 latent heat

1,135.7 B.t.u.

Heat supplied, 4,338 B.t.u.

$$\text{Efficiency} = \frac{1{,}835.7}{4{,}338} = 42.3 \text{ per cent.}$$

Miscellaneous

Besides the thermal characteristics of a gas range, there are quite a number of items of a more or less purely physical nature which are of enough importance to command our attention and investigation. Indeed, oftentimes the customer will detect defects of a visible mechanical aspect, sooner than he or she will recognize an inferior thermal condition. To be explicit, we refer to such items as the wearing out or rather loss of resilience of a door spring, the inability of a door catch to properly perform its function, the premature cracking and discoloration of enamel and what not. Therefore, the laboratory men should be on the alert to single out any point that might give rise to complaint on the customer's premises, and accordingly apply his tests in order to give any such liability of rating. This condition at once suggests to our minds whether it is not sometimes necessary to consult one of the men from the ranks—that is, an experienced and reliable fitter—in order to forecast some of the probable future defects on the range. His more experienced practical eye will detect the weak points in the makeup of the appliance at almost a glance. However, his decision and suggestions should be carefully weighed, since it is a fact that he is quite likely to point out flaws, some of which are purely imaginative. Particularly is this so if the range closely approximates the ideal.

We will only briefly point out the items alluded to, deferring the description of suggested methods for testing same for some later articles, since it is our intention to adhere as closely as possible to tests of a purely thermal nature in our first instalments.

The general appearance and attractiveness of the range should be qualitatively estimated.

Its general construction and stability should be passed upon, particularly with the idea in mind of gauging the ease and facility with which it can be transported, assembled and connected with a minimum of effort and likelihood of being damaged.

The readiness with which the linings and other removable parts can be removed and replaced should be looked into.

Any items involving an explosion or other hazard are to be ferreted out. As an example, we might mention a flue collar which will permit of placing a vessel over same, completely choking off the products of combustion.

The general construction, dimensions, etc., should conform to the N. C. G. A. specifications.

The floor temperature in the case of box ranges should not exceed 130 deg. Fahr. after the oven burners have been burning for one hour.

It is also suggested that a test be conducted in order to ascertain at what distance from the back of the oven

* The utensil used was an aluminum pan measuring 7¾ in. in diameter at the top and 5¼ in. in diameter at the bottom, with a depth of 3¼ in. Its general shape closely approached the frustum of a cone.

the temperature attains 130 deg. Fahr. after an hour's burning. This data will help in determining the distance the range should set from the wall.

The quality of the door springs and catches and other miscellaneous items should be investigated, and, as stated above, these considerations will be dealt with more fully in a later article.

A New Principle in the Flow of Heat

Carl Hering Demonstrates a Means of Improving Heating Efficiency by Breaking Through High Thermal Resistance Film

When in the usual combustion process the high-temperature flame impinges on a surface which is maintained at a much lower temperature, as, for instance, in the boiling of water in steam boilers, in cooking utensils on gas stoves, etc., the sudden chilling of the hot gases causes a very thin film of extremely high thermal resistance to form over the flame side of this surface; all the heat which flows usefully from the flame to the water must pass through this very high resistance, which means that the rate of transference of this useful heat is greatly reduced thereby, and that the usual method of boiling water is therefore a very imperfect one, declares Carl Hering in a discussion on "A New Principle in the Flow of Heat," published in the January *Journal of the Franklin Institute*.

The existence of this film is shown in the well-known experiment of boiling water in a cup of paper; also by the fact that a piece of ordinary paper, like a postage stamp, pasted on the fire side of a vessel in which water is boiled, will not be charred, though when several are thus pasted over each other the outer ones will become charred. The latter shows that the thickness of this film seems to be of the order of magnitude of about 0.005 in. hence it is extremely thin. If the flame temperature is taken as about 1,350 deg. C., and that of the water is 100 deg., the drop of temperature through this film will be about 1,250 deg. C., showing an extremely high thermal resistivity.

Resistivity of Film

Based on the heat flow through the bottom of an ordinary tin cup while water is boiling in it, the resistivity of this film figures out to be of the order of magnitude of about 79,000 in gramme-calorie-cm.-cube units, which means that a difference of temperature of about 79,000 deg. C. would have to be maintained between the two opposite faces of a centimeter cube of such a film to cause one gramme-calorie of heat to flow through it per second. The resistivity of copper in terms of this same unit is only about 1.26, and that of felt is about 8,400.

The resistivity of this film is so extremely high as compared with that of the best thermal insulators, that it is a question whether it is really a true resistance; possibly there exists what might be called a counter thermo-motive force analogous to a counter electro-motive force, which latter may sometimes for convenience be stated in terms of its equivalent in electrical resistance; or possibly the law of the transferrence of the momenta of moving masses may apply to the oscillations of the molecules which constitute thermal energy, in which transferrence it is the momenta and not the energies which are transferred equally; and the density of the cooler gases (the mass per cubic centimeter) is greater than that of the hotter ones; or a relatively very cold surface may have a tendency to reflect rather than transmit some of the heat waves. But, however the production or the physical nature of this film may be explained, the facts are that it exists and that it very greatly obstructs the flow of heat in steam boilers, water heaters, cooking utensils, etc. Until more is known about its physical nature it may in practice be treated as though it were a thermal resistance, as it acts like one.

Properties of Film

A study of the properties of this film, by the writer, showed that its resistance diminishes greatly as the difference of temperature between its two faces is decreased. The temperature of the flame and of the water being fixed, the only way to accomplish this is to greatly increase the temperature of the fire side of the vessel. This can best be done in practice by inserting between the hot and the cold surfaces of the vessel an artificial thermal resistance of such magnitude that the current of heat flowing through it will maintain the hot side at a high temperature. As the difference of temperature between the two ends of a thermal resistance is a function of both the resistance and the flow of heat (like in the electrical analogy), and as the greatest possible flow of heat is what is desired, it follows that this artificial resistance should be made of the best possible heat conductor, so that its resistance may be made as low as possible; it should therefore be made of metal rather than of insulating materials.

The thermal relations are shown roughly in the accompanying figure. The ordinates represent the thermal resistances in the path of the heat flow; the abscissæ the temperatures of the flame side of the vessel. The rapidly falling curve a then shows approximately how the resistance of this film (or its equivalent expressed in terms of thermal resistance) falls as the temperature of that surface rises. The rising curve b shows approximately the thermal resistance which must be inserted to bring that heat-absorbing surface to those temperatures. And curve c is the total resistance—that is, the sum of the two others; it is this that governs the flow of heat from flame to water, and it will be seen to have a minimum point P, beyond which it is no longer advantageous to increase the artificial resistance. Hence by increasing this resistance the flow of heat increases greatly up to a maximum point and then diminishes again. These curves are based on experimental results and not on theoretical deductions, and they are only approximate, as many other factors enter also.

Curve a may be represented by

$$xy = k,$$

which is only crudely approximate; the data for it are not yet accurately known.

Curve b may be represented similarly by

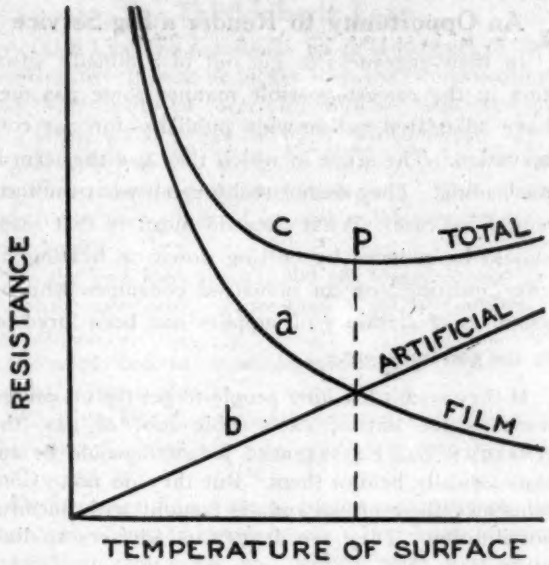
$$y = nx,$$

which also is only crudely approximate, as it curves downward. The value of x for the point of intersection, therefore, is

$$x = \sqrt{k/n}.$$

The equation of curve c, of which the ordinates are the sum of the other two, then will be

$$Y = k/X + nX.$$



Placing the first differential coefficient equal to zero, gives

$$X = \sqrt{k/n}.$$

This is the same as the value of x for the point of intersection, which shows that a minimum point exists above the point of intersection, at which, therefore, the two resistances are equal.

Method by Which Greatest Heat Flow Is Obtained

The flow of heat through the artificial resistance and through the film being necessarily equal, it follows, from the above analysis, that in this method of heating the greatest heat flow is obtained when the drop of temperature in the artificial resistance is made approximately equal to that in the film; this means that the temperature of the surface at which the heat enters the walls of the vessel should be about midway between the temperatures of the flame and the water, hence about 725 deg. C. (about 1,365 deg. Fahr.), which is a dull red heat. The more this drop of temperature in the artificial resistance is due to the flow of heat and the less it is due to actual resistance, the better. As copper is one of the best heat conductors, the maximum in practice would be that obtained when the artificial resistance is made of copper.

Limit of Rate of Flow

The limit of the rate of flow of heat would be reached when it is so rapid that the spheroidal state starts to take place; that is, when the water side of the surface is no longer kept wetted by the water. Although the writer has been able to increase the heat flow about twenty-sevenfold by this method, there were no indications that the spheroidal state had been closely approached, hence there is no probability of reaching it, and if there is, it could be easily avoided by attaching lugs to the water side of the vessel.

Unlike in the analogous case of electrical energy, there is no loss of heat energy or efficiency in overcoming these two thermal resistances; all the calories of heat which enter the hot side issue again from the cold side (assuming perfect lateral heat insulation). The resistance therefore affect only the *rate* of transmission through a given cross-section. But indirectly the thermal efficiency in this case increases with this rate; there are always some unavoidable losses of heat, and if a given quantity of water is evaporated by the same flame in, say, half the time, these losses will take place during only half the time, hence will be halved. A distinction must therefore be made between the rate and the efficiency; the writer has succeeded in increasing the rate about twenty-seven times, but the thermal efficiency in ordinary steam boilers is from 25 to 75 per cent, possibly even a little higher in some very good boilers, and therefore it could not be increased twenty-sevenfold, though the losses might be reduced to one-twenty-seventh of what they were, if the time of heating could be reduced that much.

Most Convenient Way of Making Artificial Resistances

In practice the most convenient way to make these artificial resistances is by attaching metallic lugs to the flame side of the vessel. These must be so proportioned in diameter and length that the heat flow through them will maintain their hot ends at a temperature about half way between that of the water and the flame, which is at about a full red heat; unless so proportioned they will not act as described and would merely add a little to the heat-receiving surface. Such lugs, when properly proportioned, act as though they pierced thermal openings through that highly resisting film through which the heat then rushes into the water very rapidly, as is shown by the water boiling with extreme rapidity directly over the tops of those lugs.

When these lugs are made shorter and thicker or longer and thinner than they should be, the flow of heat diminishes, as indicated by the curve *c*. As the same thermal resistance may be obtained with short, thin lugs, or with long, thick ones, provided the ratio of the diameters and lengths are the same in both, there is a choice open. Practical considerations, such as the expense, weight, space, etc., will generally decide this. Theoretically their best lengths (when vertical) would be such that the above-described relations hold good also for the sides of the lugs over which the partially cooled gases rise; the temperature of the rising gases and of the vertical lugs both diminish from the hot end up, hence if they both decrease in the same ratio, the water temperature being considered as zero, there will be the greatest possible absorption of heat by the lateral surfaces of the lugs. This means a certain freedom of flow of the hot gases, hence the spacing should not be too close.

Former Theory Underlying Use of Lugs Fallacious

The former theory concerning the use of lugs on the heated surface has been that they increase the heat-absorbing surface. While it is undoubtedly true that by increasing the surface covered by this film its resistance as a whole is reduced somewhat, yet the writer's researches have shown conclusively that the increased

(*Continued on page* 86)

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CONSTRUCTION NOTES—PAGE 16 OF ADVERTISING SECTION

An Opportunity to Render a Big Service

In their eagerness to get out of a difficult situation in the easiest possible manner some gas men have advocated nation-wide publicity for gas conservation. The sense in which they use the term is misleading. They do not really mean what the term would indicate. What they do mean is that loads should be reduced by cutting down on heating by gas, "quitting" on an industrial consumer who by promises of certainty of supplies had been lured on to the gas lines, etc.

If they meant teaching people to get the maximum useful value out of each cubic foot of gas, the AMERICAN GAS ENGINEERING JOURNAL would be enthusiastically behind them. But they do not. Consequently their propaganda is fraught with harmful possibilities. They are dangerous advisers to link up to.

At the present time the whole country is vitally concerned with true conservation, especially in regard to coal conservation. This can be accomplished to a tremendous extent by widespread substitution of gas for purposes for which coal is ordinarily employed. These are the lines along which the gas industry wants to work in its publicity efforts, and the earliest start made upon it the better it would be for the whole country.

Some authoritative body—one of the national gas associations, for instance—should provide data as to how much coal would have to be used to do a certain task converted into gas as against the amount necessary burning it direct.

With this as its basis the educational efforts should be inaugurated; first, with the intention of impressing upon the public and the authorities facts in regard to the coal-saving advantages of gas as a fuel, which we have at our finger-tips, but with which they cannot be expected to be acquainted with. Also the additional advantages that would accrue to the nation at war through vastly increased manufacture of gas should be emphatically brought home to them.

There are bigger things involved in our present situation than mere increases in gas consumption. The biggest obstacle in the way of the end we suggest is our present manufacturing capacity. Another obstacle is the difficulty in obtaining fuel. These obstacles must be brushed aside. They will not be until we discharge the obligation that is essentially ours; that is, bringing to the attention of the public and its constituted authorities facts with which they, more even than ourselves, would profit by their being acquainted with.

The Third Liberty Loan

A third Liberty Loan looms up as a prospect of the near future. It is to be bigger than the two preceding combined, and to be successful must be subscribed to by a larger number than the other two combined.

The record of one large gas company is indicative that this will not be difficult of attainment. The average citizen has been educated into the value of a Government bond.

To the first loan about 7,000 employees of one gas company subscribed. More than 12,000 subscribed to the second.

All subscribed, so far as our information goes, on the partial payment plan.

When the first came, doubtless a good many felt that they were actuated more by patriotism than by good judgment.

Perhaps they did not see where the money to meet the instalments was to come from. They knew it must come from somewhere, and perhaps many were living up to the limit of their means and could not at the time see where they could curtail.

But, sternly resolved to discharge what they viewed as a duty, they plunged into the dark. The money would be found somehow, even if they had to get along with two meals a day.

It is remarkable how much money slips through the average man's hands without conscious extravagance. Let him obligate himself to a definite amount at a definite time, and, in nine cases out of ten, he will meet the instalments without hardship, and without even being able to discover the particular items of expenditure he cut down on.

Apparently many of the 7,000 first-issue investors in the gas company alluded to had this truth brought strikingly home to them. They saw themselves, for the first time, perhaps, accumulating a valuable property without conscious effort.

Hence the 12,000 subscriptions to the second loan. Many of the 7,000 had come back for a second plunge, but this time not in the dark.

They had discovered a magic means of accumulating a reserve fund, and they wanted to make it worth while.

Then, too, they realized they were doing their part towards undermining the morale of the enemy military structure and equipping the American soldier to deal his blow towards overturning that structure when the proper time came.

This third loan will possibly be the great test of our citizenship.

With the first two there was the spirit of expectancy of action at any moment.

Our blood tingled every hour—waiting.

But we are now going through the inactive months of warfare. There is nothing big in progress in the fighting sense, and nothing big likely until the winter breaks on the battlefields.

We are getting the disagreeable features of a state of war and none of the thrills.

We think first of breakfast when we get up in the morning, then of the newspaper, instead of vice versa, as it will be later.

Under such a circumstance a man can safely stamp himself a patriot if he undertakes obligations that will deny him things he may desire for the coming ten or twelve months.

It will not be nearly so stable a patriotism to so obligate ourselves in future loans when men of our own blood are fighting, and our blood tingles in sympathy—and in some cases envy.

It will be more like buying ourselves a minute share in their sacrifices.

No gas company employee should find himself at the end of the war without a Liberty Bond in his possession. No gas company should be to-day without some of its funds invested in such bonds.

The Utility that Stops Growing is Dead

The annual report of the Consolidated Gas Company, of New York, which is published elsewhere in this issue, is unusually interesting.

We note above all else that the year 1917 was marked with exceptional merchandising attainments. This despite the fact that the paper also reveals the magnitude in the total of the increased cost of production due to high prices for new materials, with no increase in rates to offset it.

It can be taken as certain that the merchandising attainment did not "just happen." Without doubt it was planned in advance. And it was known at the beginning of the year that material prices would be high. The company's management might have considered at the time that increased rates were possible. It would not have been conservative, however, to count on them as assured.

Under these circumstances, viewed from a narrow perspective, it would not seem that as a business proposition an intense effort to secure new business would be particularly desirable. An increased consumption might easily have been viewed as a possible liability rather than an asset.

We have heard it said that a utility that stops growing is dead. There is considerable logic in the statement. More so, in the fact than would appear at first thought.

Any industry that marks time must, perforce, lose its initiative. The industry whose entire actuating motive is progressive development cannot afford to stop.

Instinct springs largely from habit. When the time comes to start again there must of necessity be a considerable amount of wasted energy.

It is said that the stopping and starting of the street car consumes more power than the whole length of its straight run. The same might truthfully be said of the merchandising activities of a gas company.

Those companies which have let down in their merchandising activities because there was no money in the new business are quite likely to discover in the long run that the cost has been higher than it would have been had they continued to progress through these, at the longest, comparatively lean years.

It takes time, money and effort to develop an aggressive and productive merchandising organization. Those companies which have allowed even the skeleton of their organizations to disintegrate, and grow lackadaisical in their outlook, must start again at the beginning. Worse, they must start all over again in working up a receptive interest in their communities. On the whole, it would seem better business to pocket the deficit in the cubic feet of gas sold to-day in the hope of the thousands of cubic feet sold at a profit in the future.

A New Principle Heat, Etc.

(*Continued from page* 82)

flow is by no means a function of this surface, and that the older theory is therefore quite fallacious, which no doubt explains why this frequently proposed method of increasing the rate by increasing the surface has not come into general use; the principle was not the correct one. Increasing the surface without breaking down the film may give a small percentage increase, but by breaking down the film resistance as described an increase of several thousand per cent was obtained.

Special attention was given to this theory of the surface in the writer's researches and many comparative tests were made; the results bore no relation whatsoever to the surface, but they were all in accord with the principle above described. In one case the surface was made four times as great as in another, yet the results were even worse. In another case the length and cross-sections were the same, but the surfaces were greatly different by making one set of lugs round and the other flat, yet the latter gave no better results.

Not Possible to Get Best Relations Between Flame and Lugs with Ordinary Gas Stove

The many-fold increase of flow obtained by properly proportioned lugs refers to the flow through the lugs as compared with the flow through the same area of the vessel as that of the cross-sections of the lugs, and therefore is of interest chiefly in showing the correctness of the principle. In practice this extreme result of twenty-sevenfold could not be reached, and probably could not even be very closely approached. The lugs in this case were rather far apart; when closer together the flow in each lug becomes less, but the area covered by them then becomes so much greater that the flow per square inch of total surface of the vessel is greater.

With ordinary tin cups over a quiet Bunsen flame of about the same diameter as the bottoms of the cups, and shielding the sides of the cups from the flame, the same amount of water was evaporated in nearly one-quarter of the time with nearly one-quarter of the amount of gas. With the ordinary gas stove, in which it is not possible to get the best relations between flame and lugs, the evaporation was about twice as fast with half the gas. Further refinements in the best application of this principle will probably lead to still better results, especially when the flame also can be made the most appropriate for this purpose. If in steam boiler practice the rate could thereby be merely doubled, it would be of great importance, as it would diminish the size of the boilers by about a half.

The flow through the cup without lugs was about 1.25 gramme-calories per second per square centimeter. Through the lugs themselves as much as 34 gramme-calories were obtained, which is about twenty-seven times as fast. Through the whole bottom, including the space covered by the lugs and that between them, the rate was about 4.35, which is nearly four times that in the cup without lugs, and the best conditions had no doubt not yet been reached. The ordinary boiler practice, 3 lb. of water evaporated per hour per square foot at and to 212 deg. Fahr., is equivalent to 0.218 gramme-calorie per second per square centimeter; in such boilers the flames and the heating surfaces cannot be as well adapted to each other as in direct heating by gas flames, which explains why this is only about a sixth of the rate obtainable in boiling over gas stoves.

Utility Experts Work for Investors

Look into the record of the preferred stock of the average well-managed public utility company, and you will find material for confidence, says William H. Hodge in a recent article entitled "The Straight Road to Financial Success."

Talk with any responsible executive of these companies and he will show you why there is every reason to believe that their business will keep on growing and fair and legitimate business maintained.

The majority of utility companies are managed by experts and highly specialized organizations, equipped with the knowledge and skill obtained from years of experience.

These men know how to finance, design, construct and operate public utilities in the most efficient and economical way.

The largest bankers and capitalists of the country rely upon their judgment and ability.

You can make this seasoned ability work for you and your interests if you are willing to invest soundly instead of speculating.

Slowness of Human Race in Developing Industrially the Use of Coal and Hydrocarbons

It is one of the most difficult facts of history to understand the extreme slowness with which the human race developed the industrial use of coal and the hydrocarbons. It is less than 200 years since coal was first used in an industrial way, about 100 years since the birth of the coal-gas industry giving us the coal tars, and less than seventy years since shale oil was first produced in quantity. It is less than sixty years since the Drake well was drilled, and this gave birth to the petroleum industry of to-day.—*I. N. Knapp in a recent paper presented at the Engineers' Club, of Philadelphia.*

News of the Gas Industry

Chicago Company Finds It Necessary to Ask for a 22 Per Cent Rate Increase—Commission Grants a Similar Petition Without Hearing

Almost simultaneous with the application of the Peoples Gas Light & Coke Company, of Chicago, for an increase in gas rates averaging about 22 per cent, as a temporary and emergency measure, the Illinois Public Utilities Commission last week adopted a new policy regarding such applications which will go far toward solving the principal war-time problem of nearly all of the gas utilities in Illinois.

The commission's new policy was revealed by its order granting the Mount Carmel Utilities Company the right temporarily to increase its rates 15 per cent without the formality of a hearing. The increased rates become effective immediately and continue in effect while the commission is investigating the reasonableness of the new schedule. The company, however, must provide for reparation to its customers in the event the commission later decides against the increase.

Commenting on this ruling, Patrick J. Lucey, Chicago member of the commission, said: "The commission has a number of similar cases before it. In these cases the utility has made a showing that it was a paying institution, honestly conducted, until war conditions, involving increased cost of labor, coal and materials, entering into its operation exceeded its income, and asks for a temporary order for increased rates. A permanent increase in rates in most cases would involve the necessity of a public hearing in which valuations and like questions would be considered."

Exactly such a showing is made in the petition of the Peoples company. The company claims that the rates now in force do not supply sufficient revenue to enable the company to carry on the business or to meet the demands for its service. It is further stated that the decrease in operating expenses due to the change in standards of gas authorized by the utilities commission last fall has been offset by the increased cost of materials and labor.

In support of the cost statement the petition shows that the company in 1915 paid for gas oil $2,080,284, and $5,134,710 in 1917; for generator fuel $1,286,828 in 1915, and $2,445,505 in 1917; for bituminous coal $178,538 in 1915, and $352,377 in 1917, and for manufacturing labor $440,233 in 1915, and $788,510 in 1917.

Further, it is shown that the cost of 1,000 cu. ft. of gas delivered at the burner, including depreciation and interest on bonds, was 67.64 cents in 1915, with the total receipts to the company from all sources per 1,000 cu. ft. 83.14 cents. The same cost in 1917 is given as 83.35 cents. with the company's receipts 81.43 cents.

(*Continued on page* 90)

Increase in Cost of Gas Oil Alone Adds $1,800,000 to Gas Manufacturing Cost of New York Consolidated Gas Company and Affiliated Companies

Gas Sales Increased 782,241,700 Cu. Ft. Over Previous Year Which in Itself Showed an Increase of 3.92 Per Cent Over 1915—205,074 Appliances Installed—1 1-6 Miles of Hotel Ranges Installed

An unusual interest is attached to the annual report of the Consolidated Gas Company of New York, as opposed to merchandising attainments and increased consumption that would normally inspire optimistic thoughts as to the future; there is increased cost of manufacture—estimated at $1,800,000 more for gas oil alone for 1918—that lends doubt as to whether the merchandising efforts were worth while; whether it might not have been as well if the business had not been gotten.

More than 1050 employees of the company and its affiliated companies have entered the fighting services. Almost 20,000 subscriptions to the Liberty Loans by employees were financed by the company.

Until December, 1917, the combined maximum day's output of the Consolidated Gas Company and its affiliated gas companies had amounted to 125,148,000 cu. ft. Beginning with Dec. 15, the low temperature, coupled with the extraordinarily severe weather conditions, created a demand upon the company's manufacturing resources that was without parallel. On that date the output was 129,959,000 cu. ft. On Dec. 28 it was 137,210,000 cu. ft., and on Dec. 31, 155,006,000 cu. ft. The output for the last three days of December aggregated 460,613,000 cu. ft., an increase over the three corresponding days in 1916 of 134,297,000 cu. ft., or 41.16 per cent.

Excess Higher Than Output of Any Plant Except Astoria

The maximum day's output in December, 1917 (155,006,000 cu. ft.), exceeded the maximum day's output prior to December, 1917 (125,148,000 cu. ft.), by 29,858,000 cu. ft., or 23.86 per cent. This increase in the maximum day's output was equal to

the entire manufacturing capacity of the largest plant in the system outside of the Astoria plant, which has a rated daily capacity of 40,000,000 cu. ft.

The scarcity of coal undoubtedly contributed largely to the increase in the output of gas and created an extraordinary demand for room-heating appliances, the daily sales of which exceeded all previous records, more than 1,400 appliances of this character having been sold in a single day. In five days 5,044 room-heating appliances were sold.

Effect of the War

The effect of the war, particularly as reflected in the orders of the United States Fuel Administrator now in operation, upon the output of electrical energy is already making itself felt. Show window and interior display lighting, recently restricted by the Government, represents a very large volume of the commercial business of the electric companies and the curtailment of this service, as well as practically all outside illumination for six nights in the week, together with the closing down of all industries, trades and business for a fortnight of working days, will very seriously affect their revenues.

The effect of the war upon the cost of producing and distributing gas and electrical energy has already been very disastrous, and will be much greater during the present year than it was in 1917. It is estimated that the increase in the cost of gas oil alone, approximately 1½ cents a gallon, will add $1,800,000 to the gas manufacturing cost of the Consolidated Gas Company and its affiliated gas companies.

Increase in Coal Cost 34.3 Per Cent

The price of practically all the materials and supplies required in the production and distribution of gas and electricity increased very substantially in 1917. The same was true of labor. The prices of boiler coal, used in generating electricity, increased 59.2 per cent, and of anthracite and bituminous coal, used in gas manufacture, 11.3 per cent; the average increase in the price of all varieties of coal used amounting to 34.3 per cent. The price of gas oil increased 66.2 per cent, and has increased again this year 30 per cent, the increase in the price of gas oil in 1918 over that of 1916 amounting to 116.6 per cent. The increase in the price of these items alone added $4,530,600 to the cost during the year 1917 of manufacturing gas and generating electricity.

Coupled with the increase in the cost of coal has been the difficulty of obtaining it as well as a marked inferiority in its quality, causing an excessive consumption as well as impairing the capacity of the various plants.

As an insurance against any possible contingency which might interrupt the normal supply of coal, the lighting companies for years past have made it a practice to carry a large stock of coal on hand. This stock has generally been accumulated during the summer months, when shipping conditions were favorable. Mining and railroad conditions during the summer of 1917 were such, however, that the stocks of coal could not be brought up to the full quantities required and always theretofore maintained. A large amount of coal was, nevertheless, secured, and although the unprecedented demand for gas, due to the intensely cold weather during the month of December, drew upon our coal stocks much more than could have been anticipated, it is hoped that the crisis has been passed and that during the rest of the winter the companies will be able to continue to meet all the demands of the public for gas and electrical energy.

Labor Cost Increase

The increase in the cost of labor has also been very considerable, the principal causes for this being an extraordinary demand for men on the part of contractors engaged in the manufacture of war munitions and supplies, the building of cantonments and unusual activities in local shipbuilding yards, including the navy yards. The available supply was greatly diminished by the effects of the enlistment of a great many men in the army and navy, and the conscription of many others.

Cost of Protection

It is estimated that the additional cost of producing and distributing gas and electricity, due to the increase in the price of labor and materials, amounted during the year to approximately $4,838,355. The cost of labor was also greatly enhanced during the year by the obligation imposed upon the companies of protecting its gas and electric plants by maintaining at each of them a special force of guards at an expense for the period subsequent to the declaration of war against Germany of $597,690.

Notwithstanding some improvement in the revenue from the sale of residual products, credited to the cost of gas manufacture, the increase in the combined operating expenses of the gas and electric companies amounted to $9,336,003, including the increase in taxes ($1,486,626) and the increase in operating expenses due to the greater quantity of gas and electricity sold ($2,413,332).

More than 1,050 employees of the Consolidated Gas Company and its affiliated gas and electric companies are now serving in the army and navy, representing every grade of employment from departmental superintendents to day laborers.

The technical and engineering departments were particularly affected in this respect, the demand for the services of men thus qualified and the inducements offered them to join the various branches of the service having resulted in a great many enlistments. In the various clerical departments the difficulty of obtaining men to fill the vacancies thus caused resulted in the employment of many women, who are performing their duties in a very satisfactory manner.

The gas sales of the Consolidated Gas Company increased during 1917, as compared with the previous year, 595,937,500 cu. ft., or 3.66 per cent. In 1916 there had been an increase in gas sales of 3.92 per cent, as compared with the previous year.

Its gas sales and those of its affiliated gas companies in the Borough of Manhattan increased during the year 782,241,700 cu. ft., or 3.48 per cent, as compared with an increase of 3.83 per cent in 1916.

In the Borough of the Bronx the gain during 1917 in the volume of sales amounted to 285,270,000 cu. ft., or 6.61 per cent, as compared with a gain of 2.34 per cent in 1916.

The combined gas sales of the Consolidated Gas Company and its affiliated gas companies in the boroughs of Manhattan, the Bronx and Queens and in Westchester County amounted to 1,407,202,100 cu. ft. more in 1917 than in 1916, a gain of 4.79 per cent, as compared with a gain of 4.01 per cent in 1916.

(*Continued on page* 91)

Illinois Commission Starts Series of Hearings to Establish Uniform System of Accounting

In an effort to establish a uniform accounting system for gas, electric, water and heating utilities, and also a uniform system of credits and collecting and handling of consumers' deposits for service, the Illinois Public Utilities Commission has begun to hold a series of public hearings to which all interested persons are invited. The first hearings on the tentative forms for such systems were held at Springfield, Ill., on Jan. 15 and 16. Other hearings will be announced in the near future.

THE WATERBURY GAS LIGHT COMPANY has filed a certificate of capital stock increase from $1,500,000 to $1,800,000.

Qualifications Necessary at Evanston, Ill., for a Successful Feminine Meter Reader

The experiment of employing women as gas appliance adjusters having proven successful, the gentler sex is now being tried out at reading gas meters, and from all indications is proving successful at this phase, too. The Evanston, Ill., branch of the Public Service Company of Northern Illinois boasts of the only woman meter reader in the State. She is Miss Mary W. White, who gave up a career as a trained nurse for that of meter reader.

According to John S. Reesman, manager of the Evanston branch, Miss White has proven so efficient that the company is considering the employment of more women for the same work. After reading meters for two weeks in Chicago's most exclusive suburb, Miss White says the only difficult part of the work is "getting used to it." She also gives the following list of qualifications which a woman must have to be a successful meter reader—at least in Evanston:

She must be at least thirty years old, or so well settled in her habits of life that she would scorn to flirt with the janitor, the iceman or the landlord.

She must scorn gossip and prying into the affairs of those whose homes she visits. It seems that Evanston has been having trouble with gossiping meter readers.

She must positively be immune to the cruel thrusts that are constantly being made at meter readers by irate housewives.

She must not be sensitive or mind the gibes and jokes she constantly hears about herself.

She must be willing to walk and run "like anything," even in the coldest, wettest weather.

She must be willing to wear "sensible" clothes, such as heavy rubbers, sweaters and several coats.

Advertising Coke Expert in Indianapolis as a Step Toward Conservation

The Citizens Gas Company, of Indianapolis, which operates the Indianapolis Gas Company by lease, along with its own mains, and thus has a complete monopoly furnishing gas to the citizens for 55 cents a thousand cubic feet to small consumers, shouldn't have to advertise very much—but it does, sometimes. A most unique ad has just appeared in the local papers as follows:

SAVE FUEL

Buy War Savings Stamps

We are as much interested in the **CONSERVATION OF COKE** as in the **CONSERVATION OF GAS.** We can not produce enough and we want it to go as far as possible. It is the cheapest fuel in Indianapolis, but it should not be wasted.

We want our **COKE EXPERT** to show consumers how to use coke economically. He is helping the Marion county fuel administrator and his time is much occupied, but he will endeavor to respond to calls whenever it is possible to do so.

Here is a voluntary testimonial to the ability of our coke expert to get the most out of fuel. This letter was sent to one of the Indianapolis papers on December 30, 1917:

FURNACE "VETERAN" LEARNS HOW TO SAVE TON OF COAL

"To the Editor:

Your editorial relating to Tag-your-shovel day, for which January 3 has been set aside by Dr. Garfield, was reviewed with unusual interest.

It so happened that just the day previous to this announcement I was put through a thorough course of instructions in fuel conservation, heat units and circulation by an expert from the Citizens Gas Company.

I have been firing furnaces for many years, but discovered that I knew very little about fuel economy. I now make the assertion that for the balance of the current winter I will save at least one ton of fuel. This means that for an entire season I should save at least two tons.

Now, if a set of similar instructions involving every phase of this all-important subject, compiled by a committee of experts like F. C. McCaughan, is made public, either through the newspapers or a pamphlet freely distributed, I think wonderful progress will be made toward fuel conservation.

It does not require an expert mathematician to figure what it means to Uncle Sam if each family in the United States is shown how to save a ton of fuel.

E. J. HERRMANN, 3026 Kenwood Ave., Indianapolis."

If you are fortunate enough to secure a little of our **BY-PRODUCT COKE** and have not used it before, call us up and leave a request for our **COKE DEMONSTRATOR** to come to your house and start you right. Do not call him unless you need him, and be patient if he does not respond immediately. He will come as soon as possible and his visit will be worth a great deal to you and should result in saving fuel to help others in this time of need.

DON'T WASTE FUEL

CITIZENS GAS COMPANY

Main 2541 ——PHONES—— Automatic 25-376

Chicago Company Asks for Increase

(*Continued from page* 87)

The company's petition gave the net earnings, after deducting depreciation and paying bond interest, as follows:

1914	$3,292,467
1915	3,228,965
1916	2,077,258
1917 (Dec. estimated)	*455,514

*Deficit.

Nor can the company, according to the petition, see any betterment of conditions during 1918.

"The applicant estimates," continues the document, "basing its figures on total sales for 1917, with an increase of 5 per cent, that the total sales of gas for the calendar year 1918 will be approximately 24,922,767,000 cu. ft., and that the cost at the burner, assuming there will be no further increase in the cost of manufacturing gas (including bond interest), is estimated at approximately 86.51 cents per 1,000 cu. ft.

"The average amount received from the consumers of gas since the adoption of the schedule of rates on Aug. 1, 1917, has been approximately 69 cents, and the applicant estimates that the same rates applied in 1918 would result in approximately the same amount (69 cents) as the average price per 1,000 cu. ft. for all gas sold.

"The applicant estimates that during 1918 its income from all other sources will amount approximately to 11.72 cents per 1,000 cu. ft. sold, so that in the event the applicant continued to sell gas during 1918 at the rates provided in the schedule of Aug. 1, 1917, the total receipts from all sources would aggregate only 80.72 cents, as against a cost at the burner of approximately 86.51 cents, including bond interest on the present outstanding bonds."

Despite this showing by the gas company, its application to the State commission brought forth a storm of indignation from the city council, and indications are that once more the gas question will become the political football of Illinois.

Within twenty-four hours after the Peoples company had notified the city of its application for a temporary increase in rates, the city council did the following things:

1. Went on record as opposed to the proposed increase in gas rates.
2. Discussed the advisability of a municipal gas plant to compete with the Peoples company.
3. Instructed its gas committee to consider the possibility of seizing the gas company's plant and operating it as a municipal utility.
4. Instructed the city corporation counsel to "take such steps as will protect the city and the consumers' interests."
5. Listened to a plan whereby the city "could give gas away and still make money."
6. Called another special meeting to consider the matter further.

The temper of the council may be judged from the statement of Alderman Kennedy. "The gas company has shown time and again that it treats the city council as fools," he told his fellow aldermen. "It seems after fifteen years of this a new policy will be worth considering. The people should let them keep their gas plant and we should build a new one. We would then not have to pay interest on the old plant and the one that is being built. We can furnish gas at 15 or 20 cents per 1,000 cu. ft. I am informed that the city could give away gas and still make money from the by-products."

The resolution introduced by Alderman Kennedy called on the gas oil and electric light committee, among other things, to submit the following questions to its gas experts:

"In case such condemnation (of the Peoples plant) would be permissible, would the price to be paid be based on the physical value of the plant? Has the city the right, under the statutes, to operate a municipal gas plant, and what would be the estimated cost of an entirely new gas plant with a system of mains reaching to all parts of Chicago."

After lengthy arguments the council decided to maintain the attitude that it did not recognize the utilities commission's jurisdiction over contract ordinance which affect the relations of the city to public service corporations. In line with this stand, the council refused to direct the city's attorneys to appear before the commission in the matter.

The attitude of the aldermen is based on their claim that the company in asking the State commission for a temporary emergency increase broke the contract entered into with the city on July 31 last, wherein each side agreed not to seek a change in rates for one year after that date. The contract referred to was part of the municipal ordinance authorizing the company to revise downward both its rates and the standard of its gas.

In its petition to the State commission the Peoples company points out that to comply with the terms of its contract with the city the company must erect a coal gas plant, which will require the expenditure of more than $10,000,000 within the next three years. It declares, further, that it will be unable to borrow money for this purpose unless its credit remains unimpaired and its earnings are put on a sound basis.

The petition continues: "In order to carry on its operations and serve the public, pay its bond interest, preserve its credit and raise funds as aforesaid, it is necessary that the applicant shall increase the price for gas to its consumers by an amount equal to 22 per cent of the net amount of each bill."

Simultaneous with the filing of the company's petition at the State capital, Springfield, Ill., Boetius H. Sullivan, attorney for the Peoples company, appeared before the Chicago city council and read a copy of the petition to that body. In reply to a question from Donald R. Richberg, attorney for the city in gas matters, Mr. Sullivan said: "Bring your experts and anybody you wish. The company will be pleased to have its business investigated. We want everybody to be present. The company is anxious to get the facts before the public."

After Long Drawn Out Request Rome, (Ga.) Company is Granted Increase

Effective Feb. 1, 1918, the new rates for Rome, Ga., will be $1.50 per 1,000 cu. ft. net and a minimum charge of $1. This decision comes from the railroad commission of Georgia after continuous efforts toward this end had been made by the Rome Municipal Gas Company for the past year. The previous minimum charge has been 25 cents.

Increase in Cost of Gas Oil Adds $1,800,000 to Gas Manufacturing Cost of N. Y. Companies

(*Continued from page* 88)

205,074 Appliances Installed in Year

During the year the Consolidated Gas Company and its affiliated gas companies installed 205,074 appliances. There were surrendered to the companies 67,410, leaving a net increase of 137,664 in the number of appliances in use, which have been installed by the companies, as against the net increase in the previous year of 108,852, and in the years 1915 and 1914 of 90,396 and 61,570, respectively. The net increase in 1917 included 2,856 hotel and restaurant appliances, 3,888 industrial appliances, 3,197 gas-fired steam radiators, and 28,382 miscellaneous gas-heating appliances.

The use of gas instead of coal for cooking in hotels, restaurants, clubs, and miscellaneous institutions is becoming more and more general. In 1917, 6,217 linear feet (1 1/6 miles) of hotel ranges were installed, an increase of 1,011 ft., or 33 per cent over the number of feet installed in 1916. On Dec. 31, 1917, the Consolidated Gas Company and its affiliated gas companies had on rental to consumers 462,332 cooking appliances of various types, an increase of 13,521 over the number in use on Dec. 31, 1916.

We are informed that the need of the Government for toluol and possibly benzol for the manufacture of high explosives is urgent and imperative, and that any delay in the obtaining of toluol means crippled artillery service and an unnecessary sacrifice of the lives of our soldiers. Both of these light oils may be recovered from manufactured illuminating gas.

The Government is now making every preparation to recover toluol from the gas manufactured by the Consolidated Gas Company and its affiliated gas companies. While such recovery will somewhat impair the illuminating quality of the gas, its value for heating purposes and for utilization in incandescent mantle burners will be rather improved than otherwise. By the substitution of mantle burners for the open-flame burners, consumers will obtain substantially better illumination at a considerably diminished cost, including the cost of the mantle.

It is expected that by the time the Government is ready to proceed with the recovery of toluol the candlepower standard, which has been virtually abandoned throughout the world, will be repealed and such calorific standard substituted as will permit the recovery of all of the toluol contained in the gas.

528 B.t.u. Prescribed by Massachusetts Board

The Massachusetts Board of Gas and Electric Light Commissioners recently prescribed 528 B.t.u. as the proper standard, and stated that it would "permit the companies to recover for the Government the toluol and benzol so imperatively needed." This standard was fixed after extensive practical tests, which demonstrated that a reduction in the B.t.u. in the gas, even though considerable, really made no practical difference to the consumer, when the gas distributed was of a uniform and stable quality and fixtures were properly adjusted.

There are still many miles of gas mains temporarily located above ground on account of the continued construction of rapid transit subways. As the gas in these mains is exposed to sudden variations of temperature, it is extremely difficult to maintain at all times the statutory illuminating standard throughout the district.

In extremely cold weather, when the frost has penetrated to the depth of the underground gas mains, condensation ensues and a similar effect on the illuminating quality of the gas is experienced, as in the case of the mains temporarily placed above ground.

Recent tests made on overhead mains crossing Fourteenth Street have proved that, where they are exposed for comparatively short distances, the temperature of the gas is reduced to nearly that of the surrounding atmosphere.

Everything possible is being done, however, to maintain throughout the district the standard and quality of gas prescribed by statute.

Employees Subscribe Heavily to Liberty Loan

When the first Liberty Loan 3½ per cent bonds were issued, the employees of the Consolidated Gas Company and its affiliated gas and electric companies were offered the privilege of subscribing to and of paying for the same in instalments of fifty equal weekly payments, or twelve equal monthly payments, the bonds to be held in the meanwhile for their account by the respective companies. This privilege was availed of by 12,357 employees, who subscribed for an aggregate amount of $847,700. Similar action was taken in respect of the second Liberty Loan 4 per cent bonds, and 7,478 employees subscribed thereto for an aggregate amount of $511,750.

The municipal street lamps on the lines of the Consolidated Gas Company and its affiliated gas and electric companies on Dec. 31, 1917, consisted of 7,112 incandescent gas lamps, 201 open-flame gas lamps, 431 electric arc lamps and 65,335 electric incandescent lamps, a total of 72,648 street lamps.

The total number of gas meters in use at the end of 1917 was 964,098 and of electric meters 353,660.

The combined sales of gas of the various companies during the year were 30,778,670,800 cu. ft., an increase over the previous year of 4.79 per cent.

The sales of electric current during the year, including sales to the Third Avenue Railroad Company, the Brooklyn Rapid Transit Company and the New York, New Haven & Hartford Railroad Company, amounted to 749,827,761 kilowatt-hours, an increase over the previous year of 11.37 per cent.

The taxes charged against the earnings of the Consolidated Gas Company and its affiliated gas and electric companies during the year amounted to $6,940,751, as compared with $5,454,125.08 charged against the earnings of the previous year.

There was expended during the year for additions to and extensions of the producing and distributing plants of the various gas and electric companies the sum of $5,200,455.22.

At a cost of $4,924,834.82 for repairs and $1,500,893.03 for renewals, or a total cost of $6,425,727.85, all of these gas and electric properties have been maintained at the highest possible point of operating efficiency, thus insuring the best results as to the quality of the gas and electric service as well as to economy in the cost of the production and distribution of gas and electricity.

January 21, 1918.

The following is a condensed statement of assets and liabilities, December 31, 1917:

ASSETS

Fixed assets, including land, plant and equipment	$54,049,787.61
Bonds and stocks of and advances to affiliated companies and other investments*	112,043,740.25
Bonds and mortgages	375,000.00
Cash	1,800,602.72
Accounts receivable	6,524,700.53
Material and supplies	1,197,985.43
	$175,991,816.54

LIABILITIES

Capital stock	$99,816,500.00
Convertible debentures	24,846,772.50
Accounts payable and accrued charges	4,754,809.48
Stock premiums	13,918,878.23
Renewal and reserve funds	12,764,417.10
Profit and loss	19,890,439.23
	$175,991,816.54

*Includes $850,000.00 par value of United States Liberty Loan Bonds.

The figures thus far available respecting the Consolidated Gas Company's operations for the calendar year 1917 indicate that its earnings from its gas business during the year (after deducting the reserve for plant withdrawn from service but without deducting the reserve heretofore made for contingencies, the provision therefor having this year been made by a charge directly to profit and loss account) amounted to.. $1,368,699.16

For the purpose of determining the earnings applicable (in accordance with the decision of the United States Supreme Court) to the value of the tangible and intangible property ($79,976,291.92) employed in the company's gas business, there should be added the earnings of the Astoria Light, Heat & Power Company from its gas business, after deducting therefrom the reserve for plant withdrawn from service.... 1,169,579.49

Making the total earnings from the company's gas business for the year 1917 ..... $2,538,278.65

This amount is equivalent to 3.17 per cent on the above stated value of the tangible and intangible property employed in the manufacture and distribution of the gas sold by the company.

Dividends were paid during the year on the company's capital stock, at the rate of 7 per cent per annum, amounting to... 6,987,155.00

The dividends and interest applicable to the year 1917, received on stocks, bonds and other obligations and on advances made to affiliated gas and electric companies operating in the Boroughs of Manhattan, Queens and The Bronx and the County of Westchester (excluding interest and dividends received from the Astoria Light, Heat & Power Company, the earnings of that company from its gas business being included above, but including $373,589.25 of interest received by the Astoria company on loans and advances), amounted to..... 6,695,956.91

The interest which accrued during the year on funded and other debt, chargeable against earnings, amounted to..... 1,493,158.80

Surplus (including that of the Astoria Light, Heat & Power Company) to be carried to the respective profit and loss accounts for the year 1917 ..... 753,921.76

Boston Has Record Output During Cold Spell

The output of the Boston Consolidated Gas Company during the recent cold spell reached unprecedented figures. On one day, Dec. 29, the company delivered 24,124,000 cu. ft., the largest day's output in its history. The total on that day for the Boston Consolidated and other companies in the Massachusetts Gas system was 29,914,000 cu. ft.

Bond Issue Asked of Indiana Commission

A petition has been filed by the United Gas & Electric Company, of New Albany, with the Indiana Public Service Commission asking authority to issue $300,000 of 6 per cent general mortgage bonds to be used in discharging and refunding valid outstanding obligations of the company, chiefly consisting of floating indebtedness.

Stockholders Vote $500,000 Issue at Hartford, Conn.

A proposal to authorize the directors of the Hartford City (Conn.) Gas Light Company to issue $500,000 of common stock was carried by vote at the annual meeting of the stockholders held recently. The new stock will be offered to the stockholders at the ratio of one new share for each four shares of the present stock. The company now has $1,250,000 of common stock and $750,000 of preferred. The par value is $25. It is said the new issue is to take care of expenditures already made and improvements contemplated.

Connections have recently been completed for serving gas to the Manchester Gas Company through mains in Silver Lane and Spencer Street, East Hartford, and to South Manchester.

The directors are to meet soon to elect officers. Judge Edward B. Bennett is president. The stockholders made no changes in the board of directors, who are: Judge Bennett, James H. Knight, Philip Roberts, Francis R. Cooley, John T. Robinson, M. G. Bulkeley, Jr., Frank C. Sumner, Philip S. Simonds, J. J. Bodell.

Increase Asked in Los Angeles County, Cal.

Application for authority to increase gas rates in Long Beach, Seal Beach, San Pedro, Wilmington and contiguous territory in Los Angeles County was filed recently with the State Railroad Commission by the Southern Counties Gas Company of California. The increase was requested in order that the company might earn a reasonable rate, equal to 8 per cent on its investment.

Ohio Oil Company Drills Second Gas Well

Ohio Oil Company has brought in a second big gas well in the Hidden dome, near Worland, Wyo., according to a dispatch received in Denver, Col. The first gasser in the Hidden field was struck two months ago by the Ohio company while drilling for oil. The gas flow was estimated as high as 8,000,000 cu. ft. daily. The well was capped, the rig moved to another site half a mile away, and the strike reported recently is the result of that drilling.

The gas in both wells was found at about 1,100 ft. The oil zone in the Hidden field is expected to be reached around 1,500 ft.

While no estimate of the gas flow in the Ohio company's second well was made in the telegram, one report stated that it was at least equal to that of the first well. The gas is unusually wet and heavy.

It is said that the Ohio company will continue the new well to the oil sands, as the gas is taken as a surety that the oil exists at greater depth.

Drilling continues on the Casper-Embar and Hecla wells on the Hidden dome, and the Ohio's discovery of gas adds to the interest in the outcome of the drilling there. These wells are expected in almost any day.

Many gas wells have been found in Wyoming. The largest, struck near Byron two years ago, had a flow of 48,000,000 cu. ft. daily, and that output has been well maintained. This gas is piped to several towns for lighting purposes and furnishes power to the beet sugar factory at Lowell. The Midland Carbon Company's plant at Crowley, the first unit of which was recently placed in operation, is also supplied by the Byron well. Commercial carbon from the gas is the product of the plant.

"Smoke" Fund for Chicago Employees in Service is Easily Collected

The building department of the Peoples Gas Light & Coke Company, of Chicago, has devised a simple and effective method of providing the gas boys who have been called to the colors with "smokes." On pay days each member of the department contributes 5 cents toward the fund. The amount thus collected enables them to send $1 worth of tobacco each month to every soldier who was formerly with the gas company.

Summary of Report to Massachusetts Commission on Calorific Standard

As the result of tests extending over a year and a half, a report relative to establishing a calorific standard for gas in Massachusetts has been rendered to the gas and electric light commissioners by Charles D. Jenkins, State gas inspector.

Nineteen plants were used for the experiments, they being free to undertake the manufacture of gas to a calorific basis instead of the candle-power requirement. A calorimeter was installed at both the official testing station and the works. At the former the supply was taken off the same as for candle-power determinations. At the works, many plants used averaging tanks of the continuous-flow or the gas-holder type.

For the official testing station it was necessary that the inspectors should be able to control quickly the temperature of inlet water to the calorimeter. A No. 2 flush tank with ball cock on inlet was placed 8 to 9 ft. from the floor, the outlet to calorimeter flowing through a 5-in. strainer of 40-mesh gauze. A visible waste indicator was introduced on the overflow line from inlet weir to calorimeter at the height of the eye. This was found very useful, as the minimum amount of water could be wasted and yet a constant level insured by an easy inspection of the indicator in line with the thermometer reading lenses.

The water supply to tank came through a gas tank heater. On the outlet was a brass cross (all piping ½-in. brass) carrying a thermometer, reading to single degrees with an open scale, and two lines, with valves, one to waste and the other to tank.

On the tank line a safety valve was introduced before the valve. The temperature of water could be nicely regulated to room temperatures. and was made uniform by a stirrer introduced into tank. When the conditions were favorable for a test, the gas and water were shut off at heater and the inlet temperature at calorimeter generally was held to 1/100 deg. Fahr.

The method of calculation was simplified by the use of a table of co-logarithmic factors; these are the co-logarithm of the amount of gas used corrected for temperature and total pressure when 2 cu. ft. are passed by the meter. The calculation is simplified by adding the logarithms of weight of water found and the corrected difference of temperature of inlet and outlet water and the logarithmic factor. To the number corresponding to the logarithm thus found is added 1 B.t.u. for heat loss and the correction for humidity from another table. The result is the total B.t.u.'s.

For purposes of comparing results, "efficiency factors" were developed, that for coal gas being B.t.u.'s per pound of coal, and for the oil in water gas a factor developed from the formula

$$B - 300 \frac{1000 - 80A}{1000},$$

where B is the observed total heating value of the carbureted water gas and A the number of gallons of oil per 1,000 cu. ft. The values 300 B.t.u. for blue water gas and 80 cu. ft. gas per gallon oil were checked by one of the companies.

Candle-power developed at gas works is not always delivered to consumers in its entirety. A test was made of water gas supplied under high pressure, which showed an apparent loss of 6.4 B.t.u. between the holder and after the compressor, this being in a warm, early autumn period. The tests were during the make. The plant was shut down for twenty-four hours and the system supplied from the stock. At a testing station one mile distant there was a gain of 23.7 B.t.u. to 551.4. Next day tests made twelve miles from the works, the system being kept filled at 10 lb. pressure, indicated 531.7 B.t.u., a loss of 3.6 per cent.

At another plant two series of tests for loss of B.t.u.'s from distribution on a 6-in. pressure line, of gas averaging 70 and 50 per cent water gas, showed an actual increase in heat value at 8 lb. pressure and a loss of 1.62 per cent under 30 lb. pressure.

Tests last winter in very cold weather showed a B.t.u. loss of 36.5 or 6.37 per cent, in distribution six miles from works.

At another plant manufacturing coal gas in machine-charged horizontals a very small loss was shown on a high heat-unit content, the temperature being at about freezing.

Experiments in connection with steaming verticals were carried

out at the Springfield Gas Light Company's plant. Twenty-four Glover-West retorts in three benches of eight were arranged so that the gas could be purified and kept separate from the other gases until a sample could be taken in the averaging holder. Twenty pounds of steam pressure was fed through a fixed aperture, reducing the pressure to 9-9.5 lb. This steam was passed through two lengths of pipe placed in a waste heat flue and acquired about 200 deg. Fahr. superheat; then, passing through an aperture less than 0.2 in. in diameter, the steam entered the retort at its lower end at 350 lb. per twenty-four hours per retort.

The superheated steam passing through the red-hot coke in the lower part of retort would be partially decomposed, forming blue water gas of about equal parts carbon monoxide and hydrogen, but analysis of the gas shows further action of the steam and water gas in preventing the cracking of the hydrocarbons. The hydrogen in the steamed sample should have increased by the same amount as the carbon monoxide if the action were only that of making blue water gas, but as the hydrogen remained the same, in proportion, as before steaming, while the carbon monoxide was increased (over 3 per cent) and the illuminants increased in total amount and also in proportion, it is fair to deduce that the introduction of steam improved the quality as well as the quantity of gas produced.

Another advantage appeared in the changed character of carbon in retorts; generally this is in a hard, compact form detached with difficulty, but when steamed the carbon is more easily detached and burns off quicker. Tests showed 43.7 per cent less time lost from retorts out for scurfing. There is also an apparent increase in ammonia production of over 12 per cent.

Questions of distribution troubles and their remedies were studied. One difficulty is the presence of napthaline in commercial gas; also easily condensible hydrocarbon vapors. These are affected by size of mains, speed of gas flow, fluctuations in pressure and weather. On a candle-power basis it is desirable to have the gas carry as much of these elements as it will, but on a heat-unit basis they are not so desirable. Naphthaline can be reduced by washing the gas with various oils; this process may reduce the volume of lighter vapors and olefine gases that are not so undesirable.

In the experiments, with a view to improving apparatus to wash gas and recover the lighter oils, gas oil was used in a standard washer scrubber, a steam-heated still was made from a boiler feed water heater and a condensor from a section of hydraulic main put on end with piping—later supplanted by a coil of lead pipe—for condensing the vapors. The outlet from Still was a 6-in. pipe 8 ft. high, filled with stones, acting as a dephlegmator. Pipe lines, pumps and storage tanks completed the equipment.

Special attention was given to chemical control of naphthaline. It was found that with coal gas the naphthaline content was reduced from 26 to 28 gr. per 100 cu. ft. to between 5 to 6 gr. by washing with gas oil. Total sulphur in the gas was reduced from 28.4 gr. per 100 cu. ft. to 19.5 gr.

The oil used assayed 5.5 per cent off at 200 deg. Cent., 28.5 per cent off at 250 deg. Cent., 62 at 300, 88.5 at 350 and 11.5 as residue. One million cubic feet of gas was washed with 1,556 gal. oil in twelve hours; 74 gal. light oils were obtained, equal to 4.76 per cent of wash oil used. These light oils distilled off from the benzolized oil gave 34 per cent to 100 deg. Cent., 22 per cent to 120, and 7 per cent to 135 deg. Cent. There was found, on fractionating with a column still head, 29.5 per cent benzine, 12.8 per cent toluene and 5.8 per cent solvent naphthas.

In conclusion the report says that even under the stress of abnormal times the calorific value has remained exceedingly constant, while the c.p. has followed the usual fluctuation experienced in changing weather. "Uniformity of calorific value is to be desired, for the larger proportion of gas is used as a source of heat and a uniform quality of gas is the first element of good service to the consumer."

Dilutents, or inert gases, should be kept as low as is commercially practicable, and the gas should be so made as to insure the delivery to all consumers, in all kinds of weather, of the largest possible amount of heat units.

The removal of toluol and benzol reduces the colorific value only 6 to 7 per cent.

"The minimum calorific value required of gas companies should be set at such a figure as to make the recovery of these elements feasible," says Mr. Jenkins, who suggests that it appears desirable that the commission set a minimum heat unit standard at not over 525 B.t.u. This figure might need revision in the early future.

The report contains voluminous detailed reports and data gathered in the course of the investigation. These include tables for calculation, efficiency factors for coal and oil, burner tests, detailed reports of B.t.u. and candle-power by the several companies, and State inspections and comparisons.

Oil Production Breaks the Record

Preliminary estimates by John D. Northrop, of the United States Geological Survey, Department of the Interior, indicate that the quantity of petroleum produced and marketed in the oil fields of the United States in 1917 reached the record-breaking total of 341,800,000 barrels, a quantity nearly 14 per cent greater than the former record output of 300,767,158 barrels, established in 1916. The production is apportioned among the major fields as follows:

Field	Barrels 1916	Barrels 1917
Appalachian ...	23,009,455	24,600,000
Lima-Indiana ..	3,905,003	3,500,000
Illinois	17,714,235	15,900,000
Okla.-Kans. ...	115,809,792	147,000,000
Cen. & N. Tex.	9,303,005	11,000,000
North Louisiana	11,821,642	8,700,000
Gulf Coast.....	21,768,096	24,900,000
Rocky Mountain	6,476,289	9,200,000
California	90,951,936	97,000,000
Other fields....	7,705	.....
	300,767,158	341,800,000

The salient features of the industry in 1917 were the record levels reached and firmly maintained by prices of crude oil at the wells and the enormous demand, which absorbed not only the current output of the wells but necessitated a net draft of about 21,000,000 barrels on oil in storage, principally in California and Illinois. The surface reserve of crude oil in the United States at the end of 1917 is estimated at 153,000,000 barrels.

Massachusetts Commission Submits Bills for Legislation

The Gas and Electric Light Commission of Massachusetts has filed with the clerk of the House of Representatives bills covering the following measures which the board advocates:

A bill to clarify and strengthen the present law which provides that gas or electricity used by a municipality having a public plant shall be charged to it at cost.

The bringing of municipal plant managers in the State under the civil service. This is true now of several managers of municipal plants, notably that of the city of Holyoke.

A bill giving the board authority to establish rules to govern the quality of gas supplied, in particulars not prescribed by law.

The immediate repeal of the candle-power gas standard, in view of the Government's dependence on gas plants for products entering into the manufacture of explosives.

A bill providing for the emergency connection of gas with electric companies in order to conserve the coal supply, and the shutting down of unnecessary power and gas plants, together with the conservation of steam power.

The 1918 Legislature recently convened, and it is expected will take prompt action on the above bills.

New Rates for Omaha, Neb.

Beginning with Jan. 1, 1918, the Omaha (Neb.) Gas Company has increased its rate 15 cents per thousand, so that the present rate is $1.25 per thousand, with a discount of 10 cents per thousand, if bills are paid on or before the 10th of the month following that in which the gas is consumed. The former rate was $1.10 per thousand, with a discount of 10 cents per thousand under the same conditions.

This JOURNAL is indebted to William H. Taylor, manager of the company, for the foregoing information.

Rock Island, Ill., Increase Asked

Claims of the Peoples Power Company for higher gas rates will be put before the public utilites commission soon, it was stated following a meeting between representatives of the company and the city council recently. Representatives of the company put the matter of higher gas rates formally before the council, which that body opposed.

The company at present has a sliding scale of gas rates. At the meeting mentioned the power company representative stated that the power company intended to raise the rates 15 cents per 1,000 cu. ft. Present rates of the company are:

Regular Meters	
All gas used per meter per month:	Per M. Cu. Ft. Net Gross
First 50,000 cu. ft. or fraction thereof .....85c.	95c.
Next 50,000 cu. ft. or fraction thereof .....75c.	85c.
Next 50,000 cu. ft. or fraction thereof .....70c.	80c.
Next 100,000 cu. ft. or fraction thereof .....60c.	70c.
All gas used in excess of 250,000 cu. ft. .....55c.	65c.
Prepayment Meters	
For all gas used, per M. cu. ft. .....90c.	

Greatly increased cost of materials used by the company is given as the cause for the proposed increase, members of the company stated. Coke, coal and oil are much higher, which necessitates the changes. Coke is $14 a ton, as against $5.25 three years ago. Oil has advanced from 3 cents a gallon to 7 cents, while the price of coal is also much higher. Labor, too, costs more.

It is figured that the output of gas will cost from 75 to 78 cents per 1,000 cu. ft. this year. All gas and electric companies have been affected in a similar manner, it is claimed, and a raise in price is inevitable.

If the raise is granted, Rock Island, Moline, East Moline and Silvis consumers will be affected.

Scranton's Prepayment Meters Being Changed for New Rates

Twenty thousand quarter gas meters throughout Scranton, Pa., will have to be regulated to conform with the new schedule of rates of the Hyde Park Gas Company which went into effect recently. Officials of the gas company stated that the work of regulating the meters would take at least three months.

The new rate can be easily applied to the old meters, but when the rates are applied to the quarter meters the changes, of course, are necessary. Men have already started out in various sections of the city to regulate the quarter meters.

The new gas rate of the gas company, which provides for a minimum charge of 50 cents per month for each meter installed and an advance of 10 to 20 cents per 1,000 cu. ft. of gas, went into effect.

As filed with the public service commission at Harrisburg, the new schedule of rates follows:

"For a monthly consumption of less than 15,000 cu. ft., $1.15 per 1,000 cu. ft.; 15,000 to 25,000 cu. ft., $1.05; 25,000 to 100,000 cu. ft., 90 cents; 100,000 to 300,000 cu. ft., 80 cents, and 300,000 cu. ft. and over, 70 cents."

The Capouse Gas Company, which operates in Dickson City, also put into effect new rates at the same time. The rates provide for a minimum charge of 50 cents per month for each meter installed and a reduction over the old rates of from 30 to 5 cents per 1,000 cu. ft. The new rates are similar to the Hyde Park Gas Company's schedule.

Personal Notes

J. P. CROWLEY has been elected vice-president and treasurer of the St. Paul (Minn.) Gas Light Company. Mr. Crowley is a prominent figure in the gas and electric service in St. Paul. He was educated in the St. Paul schools and colleges, and at one time was accountant for the Edison Electric Light & Power Company. Later he became secretary of the St. Paul Gas Light Company.

FRED C. HOFFMAN has been appointed secretary and office manager of the St. Paul (Minn.) Gas Light Company, succeeding J. P. Crowley. Mr. Hoffman was born and educated in St. Paul, later completing his college education at St. John's College, St. Cloud. He has been with the company twenty years, serving in various capacities and clerkships. For the past seven years he has been purchasing agent.

H. H. DUNN, formerly commercial and industrial engineer for the Roanoke (Va.) Gas Light Company, is now secretary of the Chamber of Commerce at Winston-Salem, N. C.

WILLIAM H. PARKER, for sixteen years in the employ of the Providence (R. I.) Gas Company, resigned his post there to accept a position with the United States Knitting Company, of Pawtucket. Just before he left associates gathered about Mr. Parker's desk and presented him with a pair of gold cuff links and a pipe. Mr. Parker was a bookkeeper in the executive department of the gas company, and he goes to the United States Knitting Company to take charge of the office.

DEAN W. FLOWERS, who has been superintendent of the gas and electric plants of the St. Paul (Minn.) Gas Light Company, has been appointed engineer of the company. Mr. Flowers came to St. Paul four years ago from Long Branch, N. J., where he built and operated gas and electric plants, as well as at Binghamton, N. Y. He is president of the Twin City Alumni Association and an officer of the St. Paul branch of the American Society of Mechanical Engineers.

B. F. PELTON has been named manager of service for the St. Paul (Minn.) Gas Light Company. Mr. Pelton came to St. Paul from Denver thirteen years ago and has been superintendent of distribution, in which capacity he has had charge of much of the construction and maintenance work.

CHARLES HUBBARD JOHNSON, eighty-nine years of age, completed sixty-five years of service with the Boston Consolidated Gas Company recently. He was born in Boston, and now finds himself not only the oldest living employee of the company, but also the only one living who was connected with it when he began his career.

E. O. GRIGGS, who has been local agent for the East Ohio Gas Company during the past several years, has resigned his position and will be employed by the Ohio Match Company.

HENRY L. MANSFIELD, for a long term of years secretary and treasurer of the Middletown (Conn.) Gas Light Company and for many years a member of the city board of water commissioners, died Jan. 14, at his home on Broad Street, following a short illness.

Societies and Associations

THE RO-GAS-CO ASSOCIATION, composed of the officers and employees of the Rockford (Ill.) Gas Light & Coke Company, tendered a farewell dinner to Mr. and Mrs. R. G. Porter, Jan. 5, at Unity Hall. Mr. Porter has been in Rockford for the past three years, having built the new gas works there, and has been promoted to a bigger engineering job at one of the company's plants at Chester, Pa. After the dinner the toastmaster, Harry L. Wolfe, on behalf of the friends assembled, presented the Porters with a silver service set. Short talks were made by H. S. Whipple, A. W. Kendall, F. S. Madden and Ray Doherty, and almost the entire assemblage was called upon for remarks, all carrying the same message to Mr. Porter and wishing him success in his new position. Mr. Porter responded feelingly, and thanked the members for the co-operation he had received while here. Mrs. F. S. Madden played several piano selections and accompanied by Mr. Oblander with his musical instruments, forming an orchestra for dancing, which lasted until a late hour. About eighty-five employees were in attendance, and all had a splendid time. Mr. and Mrs. Porter left Jan. 6 for Philadelphia, Pa.

THE CENTRAL HUDSON GAS & ELECTRIC COMPANY employees of the Poughkeepsie branch who will soon be in Uncle Sam's armed service were given a fitting farewell reception in the spacious quarters of the company's Employees' Club in the Chamber of Commerce Building, Dec. 29, 1917. Fully 100 employees and friends were present and a most enjoyable time was passed by all. The feature of the occasion was a varied program of entertainment, which was rendered during the evening. Refreshments were served, followed by a very pleasant social hour.

THE ST. CLAIR COUNTY GAS & ELECTRIC COMPANY has been cited by the Illinois Public Utilities Commission to show cause why its securities were issued without the consent of the commission.

Gas Steam Radiator Installations at Newark, N. J.

One of the largest sales of gasteam radiators in Newark, N. J., has just been made by the builder's representative of the Public Service Gas Company, A. D. Way, Jr. It consists of supplying Clow gasteam radiators to ten small stores, which occupy the corner of New and Halsey Streets. Originally these stores were leased by the owner of the Arcade Building, who supplied heat to them from the main plant of the large building.

The remodeling of this property and the sale of the small stores made it impracticable to heat them from the central heating plant, and the new owner considered various means to supply heat. Last year an estimate was made for installing gasteam radiators, but this seemed to be too high to be considered at that time.

Meanwhile, the building opposite (No. 27 New Street) was equipped with Clow gasteam radiators, which were in use all last winter, and gave excellent satisfaction. The owner of these stores learned of the satisfactory results obtained across the street, and this year placed his order through a local plumber for the installation of thirty-one gasteam radiators. The installation consists of fifteen six-section, thirteen eight-section, two twelve-section and one fifteen-section Col Clow gasteam radiators. These were distributed as required in the various stores. The gasteam radiator has proven its worth and popularity for store heating in Newark, and there is no question of their satisfactory performance if the proper amount of radiation is sold. Mr. Way is to be complimented upon his good work in this installation.—*Service*, published by Public Service Gas Company of New Jersey.

Binghamton Has Girls for Meter Readers

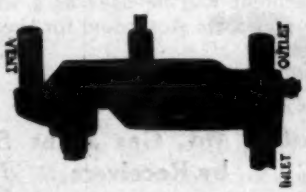
Beginning last week the Binghamton Light, Heat & Power Company employed girls to read meters and deliver bills. It has been found advisable to do this on account of the general labor condition, and it is in line with the policy adopted about six months ago of employing girls in all branches of the work where it is feasible to do so, thereby releasing as many men as possible for Federal service.

RITER-CONLEY COMPANY

STEEL CONSTRUCTION

PITTSBURGH

HIGH PRESSURE



COMBINATION STYLE
(With Mercury Seal)

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C. B. BABCOCK CO.
No. 768 Mission Street
San Francisco

REYNOLD'S

ARTIFICIAL GAS GOVERNORS
AND
NATURAL GAS REGULATORS

For All Kinds of Pressure Reduction

WRITE FOR CATALOG

REYNOLD'S GAS REGULATOR CO.

SERVICE GOVERNORS

"OLD STYLE"
(Without Seal)

Main Office and Works
ANDERSON, INDIANA

Valuation Placed on Plant at Iowa Falls in Rate Case

The first step in the adjustment of gas rates in Iowa Falls has been taken by the Iowa Gas Company in filing with the city council a statement of physical valuation of the plant, replacement valuation and operating expense. The first item is placed at $64,662.60, and the replacement valuation put at $82,699.70, while the operating expense is $81,715. This allows the company 7 per cent interest. Based on these figures, the company must have $2.17 per thousand feet of gas for the coming year. These figures will be gone over by experts engaged by the city. The company has been charging $1.50 per thousand feet of gas for several years with a discount for prompt payment. Increased cost of production necessitated action on the part of the company for a higher rate.

Construction Notes

Ohio Company Purchases 8-Story Building

The Ohio Cities Gas Company, including the Columbus Gas & Fuel Company and other subsidiary concerns scattered over Ohio, shortly will move all of its offices into the eight-story building at High and Chestnut Streets, Columbus, until recently occupied by the Green-Joyce retail store, following a deal whereby the gas company became the owner of the building and the holder of the ninety-nine-year leasehold. As part payment, the gas company turned over its building at Front and Gay Streets to the heirs of the John Hamilton estate, Philadelphia, owners of the former Green-Joyce building. The total consideration involved through the transfer of the High Street building and site lease was $500,000.

The major part of the eight-story structure will house the general offices of the Ohio Cities Gas Company, including the Columbus Gas & Fuel Company and many other subsidiary concerns now located elsewhere in Ohio. The change is to be made just as soon as the building can be made ready for occupancy. In the near future Columbus residents will pay their gas bills at High and Chestnut Streets.

$13,000 Rental

The site of the gas company's purchase is owned by Frank B. Howell, Belle Bailey and O. C. Jones, the Hamilton heirs having owned the building, which was erected on a ninety-nine-year lease. The annual rental or lease fee paid the site owners is $13,000. The unexpired sublease held by the Green-Joyce Company has been turned over to the gas company.

Gas Producer and Coal Bunker Contract Awarded

The Eastern Bridge & Structural Company, of Worcester, Mass., has the contract for the erection of a gas producer house and coal bunker at the Palmer branch plant of the Wright Wire Company. It will be of steel and asbestos metal, one story high, 16 x 32 ft.

New Plant Contemplated for Mahanoy City, Pa.

By all indications Mahanoy City, Pa., which has been without gas since last October, when the defunct Mahanoy City Gas Company plant was abandoned because the owners claimed they lost $1,200 annually on the proposition, is to have a new plant.

P. J. Durant, representing a West Pittston syndicate, has been making arrangements for the purchase of the old plant. The new company will be known as the Peoples Gas Company. They expect to be ready for operation by spring.

When the Mahanoy City Gas Company, owned and operated by C. H. Geist & Co., stopped business last October, they tried to sell the local plant for $50,000 or rent it at $4,000 per annum.

Gas Extensions and Improvements to Continue as Usual in Chicago

In a discussion of whether public improvements should be allowed to continue as usual while the nation is concentrating its energies toward winning the war, or whether the other extreme of stopping all public work be adopted, the Civil Industrial Committee of the Chicago Association of Commerce asks if a middle course which would not interfere seriously with the national activity cannot be adopted.

A statement prepared by this committee says public utility extensions, such as light, power, telephone, telegraph, water and gas, probably will continue as usual in Chicago, since they are public necessities. Doubt is expressed, however, of the chances of proceeding with the other big public improvements which had been planned and fully authorized in Chicago, such as the $50,000,000 railroad terminal, $6,000,000 worth of pavements and other similarly big enterprises which have been temporarily abandoned since our entrance into the war.

Anderson, S. C., Plant Sold at Public Sale

The Anderson (S. C.) Gas Company was sold on Nov. 5, 1917, at public sale by the bondholders' committee, that had been appointed to look after the bondholders' interest. This plant was bought in for this committee for $49,900. The new company is known as the Anderson City Gas Company, with a capital stock of $10,000. James H. Morris, of Philadelphia, is president; Frederick E. Lyford, Waverly, N. Y., vice-president; Francis A. Courtney, of Philadelphia, secretary and treasurer.

This JOURNAL is indebted to W. R. Wones for the foregoing information.

Store in Manchester Leased for Use as Storeroom

The Manchester (N. H.) Gas Company has leased a store in the Hull Block on Main Street for its office. Part of the store will be sublet to the Park Hill Flower Shop. The basement will be used as a workshop and the storeroom for the gas company.

Easton, Md., Gas Plant Sold by Receivers

The plant of the Easton (Md.) Gas Light & Fuel Company, owned by Philadelphia capitalists, and which has been in the hands of W. Mason Shehan and G. Elbert Marshall, receivers, was sold recently to New York parties for $8,800.

A New Dollar Mine

Appliance men who are not selling water heaters in middle class homes are overlooking the greatest opportunity in the appliance field.

AMERICAN

Gas-Fired Automatic
Water Heaters

—are sold at a price that is within easy reach of the man of modest means, and offer a wonderful opportunity to the appliance man who is looking for a heater that will boost his sales beyond the mark of previous years.

Write the American Sales Department for Interesting "Reasons Why"

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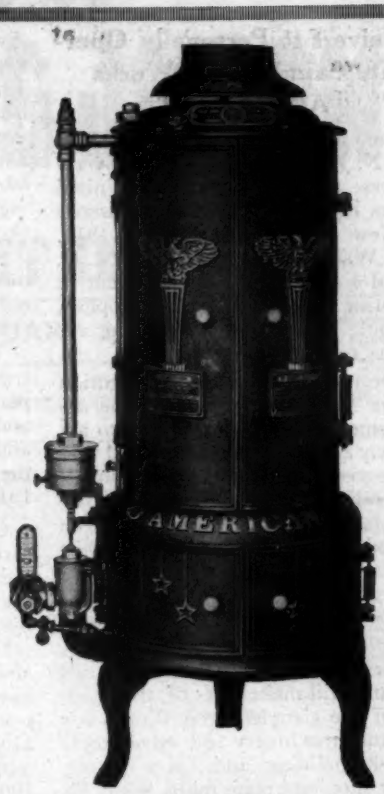
SAINT LOUIS, MISSOURI



A Busy World Is Short of Labor

Storekeepers, manufacturers, business men everywhere are up against a shortage of labor. Grasping every idea for better, faster work, they are not overlooking LIGHT—the Dad of all efficiency —eye-resting gas light.

Safety with speed requires an even spread of illumination everywhere, and gas with the

"Reflex-20"

makes this possible because of the low cost of installing, the low cost of maintenance and gas, and the high power of the unit. Hence the Harvest for the Gas Company with the "Reflex-20." Materials enough on hand to make up some more lamps, but to be sure of present prices you should get your orders in today.

WELSBACH COMPANY
Factories: Gloucester NEW JERSEY

The "C-C" Lighter—"the pilot that won't blow out"—is making a hit on "Reflex-20" installations

Receivers to Personally Operate Camden Iron Works After Feb. 22

The Camden Iron Works, of Camden, N. J., have been operated by receivers appointed by the United States District Court for the District of New Jersey since Oct. 22, 1914, with Walter Wood, trading as R. D. Wood & Company, as their agent in soliciting orders, purchasing supplies, shipping product, and collecting accounts for the receivers.

The receivers beg to call attention to the fact that on Feb. 21 the arrangement with Walter Wood to act as their agent will terminate, and that the receivers will thereafter personally conduct all of the operations of the plant under the direction of the United States Court. All proposals, contracts, purchases, shipments, payments, and collections will thereafter be made by the receivers from or at their office in Camden, N. J.

The receivers will take inquiries for, and will make sales of, the product of the Camden Iron Works for hydraulic machinery and valves, tools for shipbuilding and forge plants, boiler shop and plate mills, gas holders, purifiers, condensers, scrubbers, etc.; sugar machinery, vacuum pans, multiple effect evaporators, liquor tanks and bag filters; centrifugal pumps, gas products, special traveling cranes and hydraulic jib cranes; structural steel and plate work, cast-iron pipe and general foundry and machine work.

The above announcement has been made in a recent circular letter sent out by Heulings Lippincott, Alfred J. Major, receivers.

Lewiston, Me., Case Dismissed in Favor of the Gas Company After Two Years Litigation

In a decision made public Jan. 21, 1918, in the case of Margaret M. Hines et al vs. Lewiston (Me.) Gas Light Company, the public utilities commission orders the "complaint dismissed." Formal complaint was filed against the company Jan. 1, 1916, and in the two years which have elapsed conditions relating to the manufacture of gas have changed materially, the prices of coal, oil, labor and materials of all kinds having advanced greatly. The net returns on the present value of the plant is about 6 per cent. The commission rules that rates which net not more than 7 per cent are not excessive.

The cost of manufacture and distribution in 1916-17 was 11.14 cents per thousand more than in 1915-16, and the higher cost of oil alone will add 10.25 cents per thousand for the current year over that of 1916-17.

Considering the cost of manufacture in 1916-17 and adding the increased cost of coal as it existed at the time of the hearing last June, and the extra cost of oil, offsetting all other added costs of labor, supplies and materials against possible economies of operation, the operating expense during the present year will be $1.0327 per thousand feet, and if the output is increased 15,000,000 ft. to 100,000,000, the company would earn about 6 per cent on the present value of its property.

The rates charged by the Lewiston Gas Light Company are not now excessive, but whenever operating costs return to a condition where these rates net more than 7 per cent on the value of the plant a reduction ought to be made.

The somewhat lengthy decision ended with the following conclusion:

"The necessary conclusion appears to be that the present rates are not now unreasonable. A valuation has been established which may very readily be adjusted to a future date if changed conditions at some future time warrant another investigation. We recommend that whenever the return of lower costs of labor, materials and supplies leave a return in excess of 7 per cent of the value of the plant, a reduction in rates be made, and that the respondent then consider the advisability of establishing a minimum monthly meter rental.

"This complaint must now be dismissed, and it is so ordered."

THE BOSTON CONSOLIDATED GAS COMPANY has declared a quarterly dividend of 1½ per cent, against former payments of 2 per cent.

THE VINCENNES GAS COMPANY, Vincennes, Ind., filed preliminary certificates of dissolution.

THE STANDARD GAS & ELECTRIC COMPANY has made the following report of its operating subsidiaries for twelve months to Nov. 30. Combined operating results:

Earnings from:	1917	% of Gross	1916	% of Gross
Electricity	$13,219,332.27	69.36	$11,724,501.90	69.19
Gas	4,366,681.76	22.92	3,886,754.50	22.94
Railway	805,944.54	4.23	743,422.88	4.38
Steam	471,282.36	2.47	409,629.36	2.42
Telephone	116,989.48	0.61	103,025.54	0.61
Water	42,485.85	0.22	43,913.59	0.26
Ice	36,583.23	0.19	34,603.51	0.20
Gross earnings	$19,059,299.49	100.00	$16,945,851.28	100.00
Expense account:				
Operating	$8,069,131.61	42.34	$6,573,255.82	38.79
Maintenance	1,020,540.43	5.35	955,398.82	5.64
Taxes	1,351,708.10	7.09	1,126,270.11	6.65
Expenses and taxes	$10,441,380.14	54.78	$8,654,924.75	51.08
Net earnings	$8,617,919.35	45.22	$8,290,926.53	48.92